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ASTRONOMY.

THE GREAT PYRAMID AND ITS SYMBOLISMS.

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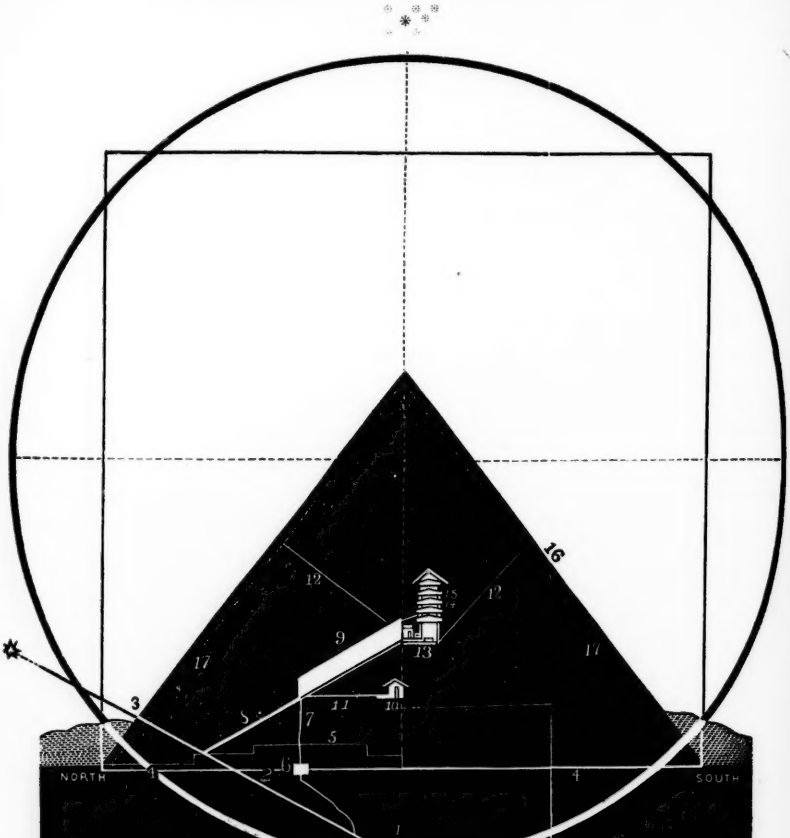
(Article II.)

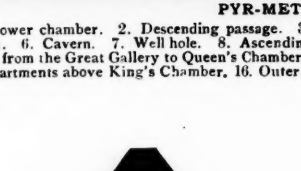
Magnitude has been supposed to constitute the distinguishing characteristics of the Great Pyramid of Cheops. We concede all that is demanded relating to its immensity. We admit that the character of the ancient Egyptians was marked with a veneration for huge proportions and prodigality of labor, without regard to either taste or beauty. We read these traits of their character not only in their many pyramids, but also in their sculpture of Ramases, the Sphynx, Cleopatra's Needle, and other relics of antiquity. And it is only in this *one* monumental pillar, which is the climax of all others in the attainment of what is superlatively vast, that we claim anything remarkably great in any other sense.

All of the many other pyramids are as destitute of science and symbolisms as images are destitute of vitality. They are mere lifeless imitations. The only attempt at imitation in the interior arrangements of any of the other pyramids, is in the descending passage to the "under world," and this was without any apparent discovery on their part of the lessons symbolized thereby in the original. This will appear on comparing a section of each of the second and third pyramids of the Jeezeh group with the first. (See figures.)

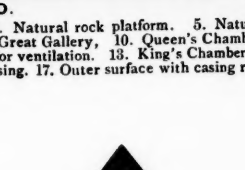


PYR-MET or PYRAMID.

1. Lower chamber. 2. Descending passage. 3. Entrance. 4. Natural rock platform. 5. Natural rock elevation. 6. Cavern. 7. Well hole. 8. Ascending passage. 9. Great Gallery, 10. Queen's Chamber. 11. Passage from the Great Gallery to Queen's Chamber. 12. Passage for ventilation. 13. King's Chamber. 14,15. Small apartments above King's Chamber. 16. Outer surface with casing. 17. Outer surface with casing removed.



SECOND PYRAMID.



THIRD PYRAMID.

To have imitated the ascending and horizontal avenues, with the rooms to which they approached (so prominent now in the first or great pyramid), would have been impossible; for they were then hermetically sealed. We now call attention to the pyramid scale of linear measure, in inches, along the interior avenues, where each inch is sub-divided with microscopic exactness, into fractions which are decimals, and add,

PROBLEM V. *The Pyramid inch is unparalleled in its fitness as a universal standard of linear measure.*

This statement accords fully with high scientific authority, as we have already shown. When the French government proposed to initiate a new metrical system which should be uniform, simple and exact, commissioners were appointed who first considered the question, *What shall be the unit of linear measure?* They were unanimous in deciding that it should be a natural and not an arbitrary standard. We admit the wisdom and propriety of this decision, and we can show that the pyramid inch approximates nearer to this qualification than any other standard ever proposed. It is natural because it is earth-commensurate. It is the one-five-hundred-millionth of the earth's polar diameter. It is simple because easily adjusted to the different measures of different countries. It differs from one inch only to the extent of .001 part, or one inch in a thousand. The French attempted to determine a natural standard and failed by $\frac{1}{5400}$ part in each meter. Hence they have now no natural standard. Shall we follow them in an admitted error which conflicts with their first principles adopted in initiating their system? Why should we when a simple, more correct, more natural one, and one much more easily adjusted to existing systems is in existence, handed down to us from the ages? Sir John Herschel says that the superficial curved meter of the French "was not a blunder only; it was a sin against geometrical simplicity."

When Edward II, A. D. 1324, decreed that three barley-corns, sound and dry, should constitute an inch, he was not endeavoring to change this measure, but to conform it to what he considered a standard more natural. But his standard was objectionable because changeable and unreliable; three barley-corns on King Edward's premises would be plumper and larger than an equal number of grains on poorer soil, or on land cultivated with less care. Hence the standard proposed was indefinite and never came into general practical use, although it long held its place in our school arithmetics. The pendulum system discussed by the French commissioners before the adoption of the meter, was rejected for similar reasons. It would vary with altitudes, latitudes and climate.

There is the same objection to Hon. Alexander H. Stephens' hair standard now before Congress. While it is simple enough, he omits to tell us what kind of hairs he would have us adopt, whether camel's hairs or horse hairs, fine hairs or coarse hairs. It gives us no intelligible starting point. A standard that is indefinite is equivalent to no standard, and ought not to be adopted by any nation—much less should it be recommended to become universal. It could never give satisfaction because definiteness is essential to a knowledge of correct-

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ness. And it must be definite also in order to be commensurate. As has been suggested by the writer on weights and measures (in the new American Cyclopædia,) let the British inch and the American inch (which already varies a little from the one from which it was copied,) be lengthened to about half the width of a very fine hair longer than the present standard, so as to correspond with the exact one-five-hundred-millionth of the earth's polar axis; and then we will have our ideal of perfection. Then we will have a natural unchangeable standard wonderfully commensurate in its millions as well as in its units with the geographical and astronomical distances computed by it. There is another grave objection to the French system which has hardly been named. The *British-French* meter contains 39.37079 inches, while the *American-French* meter contains only 39.37068 inches. This difference between these standards of two nations so allied in language and nationality, would constantly work confusion of the most inextricable kind, were both of these kindred nations to unite in adopting the French system. If we are to have a world's standard, in this age of scientific attainments, let it be the best possible. At least let it have the merits of approximate unchangeable exactness. Then it will commend itself.

PROBLEM VI. *The Pyramidal metrical system as a whole presents unparalleled claims for universal adoption.*

1st. *It is founded on the most natural and most advanced scientific principles.* It is the *ne plus ultra* and actually approximates perfection.

As we revere the Bible because it contains a perfect standard of morality, and not this perfect standard because found in the Bible, (see Matthew 22 : 40) so we recommend the pyramidal metrical system, not because found in the pyramid, but for its own intrinsic merit; because we find in it the most convenient, the most simple, the most natural, the most exact standard in existence; a standard which has been recommended by advanced scientists, as their ideal of perfection, without reference to the pyramid; a standard upon which the wonderful ingenuity of man has not been able to improve.

2d. *Its location is central.*

We have business centers, and population centers, and geographical centers. It is claimed that the pyramid is located at that point on the globe which would be the most convenient meeting place on the earth for all the people of the two continents. This is very generally conceded after careful examinations and comparisons. I do not know that a more central position, including average temperature, could be selected.

3d. *Its linear standard is founded on the earth's unchangeable axis of rotation.*

4th. *Its weight and capacity standards are founded on the specific gravity of the earth (or the whole earth's mean density) in connection with the linear standard.*

5th. *Its thermal standard is founded on the mean temperature of the earth, as marked and exhibited in its highly polished and ventilated chamber.*

6th. *Its time standard is founded on the precession of the equinoxes assisted by meridian observations combining a polar with an equatorial star.*

7th. *It is oriented so as to point exactly half way between the cardinal points of the compass; while its four faces look exactly East, West, North and South; and its apex points directly to Zenith.*

In a former article, we exhibited a practical squaring of the circle. We showed how John Taylor found *pi* (3.14159) in the pyramid. Now we present another method of finding this factor, of the circumference of a circle.

PROBLEM VII. *The area of a right section of the Pyramid is to the area of the base, as one is to pi.*

△ : □ : : 1 : 3.14159. To obtain the area of a right section we multiply the height by half the base, thus: 5813x4565.15=26539251.5. To obtain the area of the base we square one side, thus: 9131x9131=83375161. The proportion then stands thus: 26539251 : 5 : 83375161 : : 1 : 3.14154. The variation in the last fractional figure is only the half of a ten thousandth part of an inch, and as near exact as possible when the first measurements extend only to tenths of an inch. Scientific authorities tell us that no mathematical problem ever excited so great interest as the one just practically demonstrated for the second time, by a proportion in areas, as before by a proportion in lines.

Archimedes is reported as being the first among the ancients who made any approach toward the practical squaring of the circle. By inscribing and circumscribing a polygon of ninety-six sides, he discovered that a circle of 4.970 feet in diameter would have a circumference lying between 15,610 feet and 15,620 feet. This was as near as that most ingenious inventor of ancient times could arrive at it. Had he known the method of obtaining *pi*, he would have arrived at the exact solution of his problem, by the rule of proportion, thus: As 1 is to 3.14159 : : 4.970. : 15613.75 feet.

PROBLEM VIII. *The length of the ante-chamber of the Pyramid multiplied by pi (3.14159) equals in inches the exact number of days and fractions of a day in a year.*

Here we have another circle where only the diameter is given in order to find it. On this circle we have the exact number of diurnal revolutions of the earth during one solar year, thus: 116.26 inches (length of ante-chamber) multiplied by (*pi*) 3.14159=365.2412534. It is worthy of notice that there is a regard to the decimal system in the proportions of circles and squares and areas to each other, as there is in the numbers. This circle is the exact one-hundredth part as large as the circle which equals the pyramid's square base, which we see in the figure, and where we first formed the division of a year into days.

It is also worthy of notice that the *pi* proportion is adhered to with unerring tenacity, without which the mathematical figures in the pyramid would be null and void. Prof. Smyth calls *pi* (or the value of a circumference in terms of a diameter of a circle,) "*the first key to the Pyramid, the key of pure mathematics.*" He says, "If the quantity *pi* is really found built into the great pyramid, with the exactness, as well as magnitude, characterizing the whole of that vast mass, it must have been the result either of some marvelous accident, or of some deep wisdom, and settled, determined purpose." *It certainly is found there*, and it not only ante-

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dates its discovery by thousands of years, but it antedates also all known knowledge of the existence of such a mathematical quantity. Prof. Smyth thinks this implies a knowledge on the part of the architect, that this fundamental mathematical quantity would necessarily be understood without any explanatory inscriptions in our day when such progress in mechanic arts as we now see would be a matter of impossibility without an understanding of the numerical value and calculational quantity of this *pi* proportion.

PROBLEM IX. *The Pyramid gives us the exact number of years in the precessional period.*

We have already shown how by its star pointings the pyramid monumentally commemorated the beginning of the grand cycle of our solar system around Alcyone the brightest star of the beautiful Pleiades. This star, being on the celestial equator at that time, was never exactly in Zenith, but a little south of it It was exactly opposite (alpha) Draconis, the north star of that period, and with it formed the exact north and south line, by which the pyramid was oriented, before compasses were invented. Alcyone is a most wonderful star. It is said to be exactly in the great center of motion around which the universe of stars revolves. It shines with twelve thousand times the brightness of our sun, and in size it is proportionately large. If it were not so, it could not possess the attractive force sufficient to draw our whole so'ar system, with thousands of other starry systems, around it. Alcyone is so far away, that our orbit around it is more than one billion five hundred million times greater than our orbit around the sun. This is a distance so great, that if this wonderfully bright luminary had been annihilated seven hundred years ago we should still be beholding its light, which only just now has reached us. (See Ecce Cœlum).

Astronomers tell us that it takes 25,827 years for the multitude of the heavenly bodies which are attracted by it to perform their journey around it. *This is the precise duration of the precessional period.* The sun comes around to the equinoxes when the days and nights are equal, each year a little earlier than in the preceding year. This is called the precession of the equinoxes. Astronomers calculate the duration of the precessional period by dividing the number of degrees in a circle (360°) by 50.1″ or 50.2″, which is the space the equinoxes retrograde each year. They get by the first division 25,868 years, and by the second division 25,816 years. The pyramid comes between these two estimates and gives us 25,827 years, which agrees with 360° divided by the space referred to, corrected by extending the decimal fraction to two figures instead of one. But how does the pyramid arrive at this corrected estimate? It arrives at it, geometrically, by the famous forty-seventh proposition in Euclid, viz: the square of the hypothenuse of a right angle triangle equals the sum of the squares of the other two sides. In the pyramid's base we have two such triangles, and the length of each hypothenuse is 12.913+ inches, or 25.827 inches for both; which counting an inch for a year, is the exact length of the precessional period.

As we would naturally look for a symbol of a complete revolution on a circle,

instead of on a straight line, we are gratified with this additional symbol of this great cycle, on a circle of which the vertical height of the pyramid above the King's chamber is the radius. This was discovered by Prof. H. L. Smith, of Geneva, N. Y. This partial height is 4110.5 inches, which, doubled for a diameter, gives us 8221 inches. 8221 x (π) 3.14159=25.827 inches as before. Now as the circumference of this circle corresponds in length with the perimeter of the square of this horizontal section of the pyramid, on its fiftieth course of masonry, we have the same number of inches again on this square, viz: 25.827 inches. So we have the duration of the precessional period marked in three different ways, viz: on lines, on a *square*, and on a *circle*, and all exactly correspond. This proves a most marvelous exactness attained by the builders of the pyramid in the designed thickness of each course of masonry. For if the rock had been put in at random without regard to exactness in the thickness of each course, it would have been impossible on the fiftieth course of masonry, where the King's chamber is located, to have obtained the exact length of radius necessary to obtain these figures.

Plato once said, "God geometrizes." Geology says, "nature geometrizes." This is a characteristic of the Great Pyramid which distinguishes it from all other Egyptian relics. It geometrizes. When we examine the movements of some complicated machinery, we notice that its parts, though of different sizes and measurements, are proportionate, corrected and exact; and we know that without these characteristics any machine would be worthless. The more we examine the varied figures and measurements of the Great Pyramid the more we perceive these peculiar distinguishing mechanical qualities; where variety and unity are harmoniously blended. And they suggest the idea of a oneness in the whole machinery of the revolving orbs, which implies a knowledge of their sizes, proportions, distances, and correlations to each other, on the part of the architect. Such knowledge at that period, we confess our utter inability to account for on any known natural principles. We have demonstrated problems which involve this knowledge. Will scientists please account for it, or convict us of fallacy in our demonstrations.

We expected to have been able in this article to have reached the inside symbolisms which are claimed to bear on chronology, future, as well as past; but our subject has expanded on our hands, and we must defer this for another occasion.

A TABLE OF MEASUREMENTS.

Area of square base of Great Pyramid	13.340	pyr. acres.
One pyramid acre equals	0.9992	British acres.
Ancient vertical height above pavement	5813.01	pyr. inches.
One pyramid inch equals	1.0001	British inch.
Ancient and present base-side socket length	9.131.05	pyr. inches.
Ancient and present base diagonal socket length	12.913.26	" "
Ancient inclined height at corners, pavement to apex	8.687.87	" "
Ancient inclined height at middle, pavement to apex	7.391.55	" "
Elevation of pavement base above the alluvial plain.	1.500	" "
Elevation of pavement above average water level	1.750	" "
Elevation of pavement above Mediterranean sea level	2.580	" "

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Ancient vertical height of apex above lowest room . . 7.015 " "
Ancient angle of side slope . . . . . 51° 51′ 14.3″
Ancient angle of corner slope . . . . . 41° 59′ 18.7″
Latitude . . . . . 29° 58′ 51″
Solid contents of masonry. . . . . 10.340.000 pyr. cubits.
One pyramid cubit, 25 pyr. inches, or. . . . . 25.025 British inches.
The mouth of entrance passage . . . . . 50 feet above pavement.
Entrance . . . . . 25 feet east of center.
Doorway . . . . . 47.3 high, 41.5 broad. dips at an angle of 26.3°.
Subterranean rock chamber . . . . . 100 feet below the centre of the base.
Subterranean chamber is . . . . . 46 feet long, and 28 feet broad.
Ascending passage leading from the entrance passage to the Grand Gallery, has its junction with the entrance passage at about 1,045 inches from its mouth.
This passage is . . . . 47 inches in height, 41 inches in breadth, elevation 26°.
Southward up the first ascending passage to the commencement of the Grand Gallery is. . . . . 1542 inches.
The floor length of Grand Gallery from north beginning to its southern termination is . . . . . 1881-2 inches.
Height of Grand Gallery about . . . . . 339 inches, or nearly 28 feet.
Height of the door at the north end of Grand Gallery is. . . . . 53 inches.
Door at the south end leading to the ante-chamber . . . . . 43½ inches.
From the beginning of Grand Gallery floor to the well called *Souterrain*, 33 inches.
The southern wall of Grand Gallery impends . . . . . 1°.
Length of Grand Gallery midway between floor and roof. . . . 1878.4 inches.
Number of roof stones to this gallery . . . . . 36.
Number of overlapping stones on the side walls . . . . . 7.
Cubical contents of Grand Gallery . . . . . 36,000,000 inches.
Strange exit from the upper corner of Grand Gallery . . . 28 feet above floor.
Length of short passage leading from Grand Gallery to the ante-chamber 52.19 in.
Length of ante-chamber is one-fiftieth of the pyramid's height . . 116.26 inches.
Breadth from east to west . . . . . 65 inches.
The height . . . . . 149 inches.
Wall of passage way between ante and King's chambers . . . 100 inches thick.
The King's chamber is . . . . . 412 in length, 206 in breadth, 230 in height.
King's chamber shielded from outside heat or cold by . . . 180 feet masonry.
Temperature of King's chamber 68° Fahrenheit or . . . 50° pyramid standard.
From base of pyramid to King's chamber 50 courses of masonry, to Queen's 25.
Wall courses of granite in King's chamber . . . . . 5.
First four courses 4 feet high, 5th and lower one sinks one-tenth below the floor.
Outside measurement of Coffer, in King's chamber, length, 89.62; depth, 41.13; breadth, 38.61 inches.
Courses of masonry in the pyramid . . . . . 206.

MARS' FAST MOON.

The periodic time of the inner satellite of Mars is only very little over seven hours, while the axial rotation of Mars itself requires about twenty-four hours. Now, this discrepancy is in apparent conflict with the nebular hypothesis, which assumes all the secondary bodies of a system to have been evolved from their primary at successive stages, with the velocity of the primary's surface at the time of their being dropped as rings of nebulous matter. But here is a planet's satel-

lite possessed of a velocity of revolution more than thrice as high as the velocity of axial rotation possessed by its primary. The problem, how to account for this accelerated movement of the inner Martial moon, has occupied the attention of astronomers since the discovery of Mars' satellites by Prof. Asaph Hall, a few months ago. The theory proposed by Prof. M. H. Doolittle, of the Coast Survey, appears to solve all the difficulties of the case. In three ways, according to Prof. Doolittle, the relative velocities of Mars and his moon might be modified by the impact of interstellar matter, or meteorites: 1. These bodies, by striking the satellite and forcing it to travel in a narrower orbit, its original absolute velocity continuing the same, would increase its relative velocity; 2. By striking the primary, they would increase its mass and its attraction on the satellite; 3. By increasing the mass of the primary and so reducing its absolute velocity they would make the relative velocity of the satellite higher.—*Pop. Sci. Monthly.*

POSITIONS OF PLANETS FOR JULY, 1878.

COMPUTED AT VASSAR COLLEGE.

On July 1 Mercury rises at 4h. 14m. A. M., and sets at 7h. 24m. P. M., keeping nearly the path of the sun, and of course it will be invisible. On July 31 Mercury rises at 7h. 1m, A. M., and sets at 8h. 20m. P. M.; it may perhaps be seen in the evening twilight some 7° south of the place of sunset.

Mercury and Mars are in conjunction on July 22; Mercury and Uranus on the 28th.

On July 1 Venus rises at 2h. 11m. A. M., and sets at 4h. 29m. P. M. On July 31 Venus rises at 2h. 25m. A. M., and sets at 5h. 18m. P. M.

Venus is far from us and small, but is very brilliant a few hours before sunrise.

On July 1 Mars rises at 6h. 38m. A. M., and sets at 9h. 10m. P. M. On the 31st Mars rises at 6h. 18m. A. M., and sets at 8h. 4m. P. M.

Mars and Mercury are in conjunction on July 22. Mercury is further north than Mars.

In July Jupiter will light up the evening sky. On July 1 this planet will rise at 9h. 8m. P. M., and set at 6h. 40m. the next day. On the 31st Jupiter will rise at 7 P. M., and set after 4 the next morning.

Jupiter's four moons revolve around the planet in so short a time that they are often lost to sight by passing across the planet in transit, by getting behind the planet as in occultations, and by passing into the shadow of Jupiter and becoming eclipsed.

The 1st satellite, or the one nearest to Jupiter, will be invisible for a time, from one or the other of these causes, during the evenings of July 8, 9, 16, 17, 23, 24, 25 and 31.

The 2d satellite is less exposed to these phenomena, but will be invisible for a time on the evenings of July 2, 9, 18 and 25.

The 3d satellite is large, and a glass of very small power will show it approach

ing the planet on the evening of the 11th, and passing in front of it, coming out from behind the planet early in the evening of the 22d, and disappearing by going into Jupiter's shadow late in the evening on the 29th.

The 4th satellite is rarely seen to make a transit, but on July 21 it may be seen in the evening to approach Jupiter, and a good glass will show that it enters upon the disk.

On July 1 Saturn rises at 11h. 40m. P. M., and sets at 11h. 33m. A. M. of the next day. On the 31st Saturn rises at 9h. 38m. P. M., and sets at 9h. 30m. A. M. of the next day.

Saturn will come into better and better position for evening observers. It can easily be recognized, as it is brighter than the stars around it, and rises but very little south of east.

Uranus rises on July 1 at 8h. 30m. A. M., and sets at 10h. 7m. P. M. On the 31st Uranus rises at 6h. 40m A. M., and sets at 8h. 13m. P. M.

Mercury and Uranus are in conjunction on the 28th, both of them near Regulus.

On July 1 Neptune rises at 1h. 5m. A. M., and sets at 2h. 39m. P. M. On the 31st Neptune rises at 11h. 4m. P. M., and sets at 40m. afternoon of the next day.

The year 1878 is the time for the recurrence of the minimum period of the sun spots, and since last November only six groups of these spots have been seen. On November 30 a very large double spot was seen, which was visible for the last time on December 3. On February 5, a chain of about twelve spots was seen near the center of the sun's disk. These were again observed on February 6 and 7. On March 5 two very small spots were seen passing off the disc of the sun. On March 15 three spots, one of them double, were seen between the center and edge of the sun, passing off. On the 16th these were again seen, but they were much fainter. On May 27 two large spots were visible. On the 29th they appeared as one single spot, and one group consisting of three individual spots. These were last seen on June 3, passing off the disc.—*Scientific American.*

GEOLOGY.

JACKSON COUNTY, MISSOURI—A FEW NOTES ON ITS GEOLOGY.

BY PROF. G. C. BROADHEAD, PLEASANT HILL, MO.

The general surface features of Jackson county are undulating and rolling. The rise from the lower plain or river bottom at Kansas City to the highest ridge near Lee's Summit is three hundred feet, or three hundred and forty feet to higher points in the southwest part of the county, and the difference of elevation of the plains in the northeast part of the county and the ridges in the southwest is about

three hundred and sixty feet. So, although the general surface is mainly undulating and rolling, the real difference of elevation and depression of surface is not great.

The upland surface formations of the Missouri river hills are of the age of the Bluff or Loess, and rest uncomformably upon the coal measures and are especially well developed at Kansas City. These clays are here of finely comminuted material, either sand or clay or a mingling of both, and extend over the bluffs as high up as two hundred feet or more above the ordinary stage of the Missouri river. Their lower beds often repose upon a mass of boulders and pebbles of granite, quartzite or queenstone, but not of very large size, showing that if of glacial origin they are near the southern limits of the ancient glaciers. Concretions of ironsand and calcareous concretions sometimes occur.

ROCK STRUCTURE.

The rocks of this county all belong to the coal measures and include about two hundred feet of Upper coal measures and a little over two hundred feet of the Middle measures. The lowest rock at Kansas City (No. 78 of general section of Upper coal measures) may be found at base of bluff between the bridge and Union depot. Its base is thirty feet above the base of Upper coal measures and is a well marked horizon, although its fossils are not more characteristic than those of some other beds. At Kansas City we find it represented by twenty feet eight inches of grayish limestone with one foot (No. 79) of oolitic limestone above it, and overlying the oolitic portion is four feet of nodular and shelly fucoidal limestones. These limestones (Nos. 78, 79 and 80) do not change in character, nor very materially in thickness in a long distance. We find them near the base of bluff at Rock creek, forming natural escarpments high in the bluffs of Little Blue and Cedar and on the highest knobs in the eastern part of the county near Lone Jack; in Lafayette county, near Chapel Hill and near Greenton. At Kansas City bridge the top of it is seven hundred and thirty-one feet above the sea, while at Pleasant Hill, Cass county, it is eight hundred and twenty-six feet above the sea, showing a dip northwest of ninety-five feet in about thirty miles, or three feet per mile. The dip west is about double, which would make real dip about north 25° west. Northwardly these limestones are easily recognized through the eastern part of Clay, the eastern part of Caldwell, the western part of Livingston and on up Grand river through Daviess into Harrison county. Near Bethany, in Harrison county, it extends across one of our ubiquitous Big creeks, forming quite a fall, from which circumstance I have in my reports often spoken of it as the Bethany Falls limestone. The oolitic bed is nearly everywhere present, but is rather thinly developed at Kansas City; at Pleasant Hill it is three or four feet thick; near Liberty Landing, in Clay county, it is thirteen inches thick; at Kirtley's quarry, near Mooresville, in Livingston county, eight and one-half feet in thickness, and several feet thick near Princeton, in Mercer county, which is its extreme northeast extension in Missouri. We thus find it very persistent in character for over a hundred miles. It is easily

worked, forming a beautiful and durable building rock, and has also the reputation of being a good fire rock.

A general section of the Jackson county rocks would be about as follows, using numbers of the general section:

NO.	THICKNESS.	DESCRIPTION.
100	3 ft	Ferruginous limestone, hard and in even layers.
99	30 ft	of sandy shales.
98	30 ft	Irregularly bedded gray limestone.
97	25 ft	Blue shales.
96	5 ft	Bluish gray limestone containing large *Producti.*
95 } 94 }	2 ft 9 in.	Blue and bituminous shales.
93	13 in.	Fossiliferous shales.
92	13 in.	Even bed of dark blue limestone.
91	5 ft	Blue shales. Fossils abundant in upper part.
90	9 ft	Grayish drab limestone, well characterized by containing *campophyllum torquium*, O. & S.
89	5 ft	Blue and olive shales.
88	2 ft	Nodular buff colored shales.
87b	3 ft	Irregularly bedded bluish drab limestone.
	10 in.	Shales not always present.
87a	18 ft	The upper 10½ feet beautifully oölitic, the lower 4½ feet of bluish drab or gray limestone. This limestone contains a great many beautiful fossils.
86	15 ft	Blue shales.
85d	14 in.	Blue limestone. Its most characteristic fossil a species of *archæocidaris.*
85c	2 ft 6 in.	Blue clay shales.
85b	4 in.	Rotten coal and shale—with cordailes.
85a	8 ft 8 in.	Dark blue silicious limestone with lenticular forms and concretions of dark colored chert. Fossils are numerous and very characteristic.
84	9 ft 4 in.	Fine grained dove colored limestone with splintery fractions and numerous specks of calc spar disseminated.
83b	5 in.	Shales.
83	3 ft 8 in.	Irregularly bedded bluish drab limestone—contains large nautilus.
82b	5 in.	Blue shales.
82	14 in.	Concretionary ash blue limestone contains *Rhynchonella*; *Rocky Montana.* Marcou.
81c	11 in.	Blue shales.
81b	1 ft 7 in.	Bituminous shales.
81a	2 ft	Clay shales.
80	4 ft	Nodular and shelly limestone. }
79	1 ft	Oölitic limestone. } Bethany Falls limestone.
78	20 ft 8 in.	Mostly gray limestone. }
77b	2 ft 2 in.	Blue clay shales.
77a	1 ft 4 in.	Bituminous shales.
76c	14 to 18 in.	Dull blue limestone.
76b	7 in.	Blue clay shales.
76a	6 in.	Concretionary limestone with many fossils.
75	2 ft	Blue clay shales.

74	6 ft	Gray and ferruginous limestone.
73	14 ft	Clay shales, sometimes replaced by a sandstone full of irregular winding cavities.
72	2 ft	Calcareous limestone and sandy limestone, full of beautiful fossils; not distinguished from sandstone below it as we pass north.

BASE OF UPPER COAL MEASURE

71	1 ft	Blue and bituminous shales.
70	2 to 4 in.	Coal.
69	123 ft	Sandstone and shales, with about two thin layers of coal, a few bands of red shale near the upper part and occasional ochre concretions.
68	2 ft	Limestone with *Chaetetes milleporaceus.*
67	7 ft	Marly shales.
66	1 ft	Purple and red shales.
65	2 ft	Sandstone and shales.
64a	3 ft	Bituminous shales.
64	1 ft	Coal.
63	7 ft	Shales.
62	6 ft	Sandstone.
61	1 ft 7 in.	Dark shales and their concretionary bed of limestone.
60	7 ft 6 in.	Blue shales streaked with red.
59	6 in.	Coal.
58	3 in.	Dark shales.
57	6 in.	Fire clay.
56	3 ft	Sandy shales.
55	4 ft	Irregularly bedded limestone containing *Chaetetes Milleporaceus* and *Fusulina cylindrica*, Var. *robusta.*
54	6 ft	Drab, green and dark shales.
53	4 ft	Hard brown and gray sandstone.

MIDDLE COAL MEASURES.

The upper portion of the middle measures occupies the lower bluffs east of Independence. At Blue Mills Landing about eighty feet are exposed. At Sibley Landing we find about fifty-five feet of the middle part, and in the neighborhood there is found an eleven inch seam of coal. Another thin seam at a little lower horizon has also been reached in a well at Sibley. The same coal is also found in Sec. 21, T. 50, R. 29, and one foot in thickness. Its position is about thirty feet above the Lexington coal. At Napoleon, near the western line of Lafayette county, the Lexington coal should be about twenty feet below the water line. One mile west of Napoleon ten feet of No. 78 crowns a knob at an elevation of two hundred and seven feet above the river. At this place the Lexington coal may be found about twenty feet below the water line. Nos. 66 and 68 crop out at several places near Oak Grove, and one mile south we find

1	15 ft	Shales.
2	2 ft	Roughly bedded gray limestone, abounds in *Sp. lineatus.*
3	4 ft	Shales with red layers.
4		A few feet of thinly bedded limestone.

The shales and sandstones at the upper portion of the Middle coal measures, although occupying over a hundred feet in thickness in the eastern portion of

the county, do not contain any valuable beds of building rock. They do sometimes inclose thin layers of coal and occasional beds of ochre. Near Hunt' sMill the upper beds appear as follows:

1	14 ft	Limestone. Nos. 78 and 79, U. C. M.
2	27 ft	Including 5 feet of No. 74, U. C. M.
3		Outcrop of brown limestone.
4	16 ft	Shales.
5	2 ft	Red shales.

UPPER COAL MEASURES.

No. 72 lying at the base of the upper series I have nowhere found well developed in Jackson county, but is well developed at Pleasant Hill and near Harrisonville, and also in the northwestern part of Bates county. At Amos', in the southeastern part of Jackson, we have

1	15 ft	Gray limestone abounding in *Producti*, also contains a large *nautilus*. (?) Measures 1 foot across disc.
2	1 ft	Deep blue argillaceous limestone.
3	2 ft	Bituminous shales.
4	5 ft	Shales.
5	15 ft	Rough shelly limestone—No. 78.
6	10 ft	Sandstone full of holes of winding cavities. This is generally replaced by shales.
7	10 ft	Shales.
8	2 ft	Even bedded blue limestone, jointed—No. 74.
9	2 ft	Bituminous shales.
10	20 ft	Shales with a calcareous bed in the lower part abounding in *Nuculana bellistriata*, *Myalina swallovii* and *Polyphemopsis peracuta*.

On the railroad a half mile north of Greenwood we have

1	8 ft	Gray limestone—No. 83.
2	9 ft	Blue and bituminous shales.
3	6 ft	Gray limestone, the lower part oölitic.
4	13 ft	Brittle drab limestone—No. 78.
5	1 ft 6 in.	Bituminous shales.
6	3 ft	Clay shales.
7	1 ft	Ferruginous limestone containing *Hemipronites crassus* and *Syringapora multatenuata*.
8	1 ft	Calcareous and ferruginous shales abounding in *Spiriferina Kentuckensis*, *Spirifer (Martynia) planoconvexus*, *Sp. cameratus* and *Chonetes glabra*.
9		Brown ferruginous limestone.

On bluffs of Cedar creek, three miles north of Lee's Summit, we find the following series:

1		Brown limestone.
2	15 ft	Slope—an occasional outcrop of limestone appears.
3	25 ft	No rocks seen.
4	15 ft	Limestone—No. 78.
5	2 ft	Clay shales.
6	1 ft	Bituminous shales.
7	6 in.	Blue argillaceous shales.

8	1 ft		Nodular limestone and shales—No. 76.
9		8 in.	Limestone.
10	2 ft	6 in.	Blue shales.
11	4 ft		Ferruginous limestone—No. 74.

At Independence No. 98 appears to be the highest rock, and near the railroad depot we find No. 96. At Kansas City the beds are exposed from No. 78 near the water, to No. 100 on hill top. We will notice them as we ascend. No. 85 is rich in fossils, some of which are quite rare and often very well preserved. Among them I have observed very large and well preserved specimens of *Bellerophon percarinatus Con.*, larger than I have elsewhere seen. *Bell. crassus* Mk. is also found. This is the only stratum from which I have obtained *Myalina Kansasensis*, Sw. I have obtained it at Pleasant Hill, Cass county, and at Gallatin, in Daviess county, a hundred miles distant, at each place showing the well marked imbrications characteristic of the fossil, the absence of which in specimens found by others (which were only casts) caused a doubt to arise as to the species. Another very rare fossil found here is *Schizodus wheeleri* Sw., very abundant also in Daviess county. This fossil, also, I have not found in any other rocks. Other well marked fossils are *Yoldia subscitula*, *Solenomya* ———, *Edmondia reflexa*, *Aviculopecten occidentalis*, *Sh. Avic. carboniferous*, *St.*, *Aviculopinna Americanica* Mk. its lowest horizon. Good specimens of *Pinna peracuta* and *Myalina subquadrata* are also found, as well as *Platyostoma peoriensis* McC. and *Naticopsis altonensis*.

Probably the most interesting of the Kansas City group is No. 87, of which the middle ten feet is beautifully oölitic and contains a great many very pretty fossils. Over forty species have been recognized, among which I might name *Bellerophon Stevensanus* (?) *Bell Marcouanus*, *B. Kansasensis*, *Pleurotomaria turbiniformis*, *P. conoides*, *P. spironema*, *Aviculopecten carboniferous*, *Avic. providencis*, *Avic. occidentalis*, *Entolium aviculatum*, *Macrodon tenuistriata*, *Allorisma costata*, *Edmondia reflexa*, *Terebratula bovidens*, *Monotis gregaria*, *Eumicrotis Hawni*, *Allorisma costata*, *Myalina Swallovii*, *Productus symmetricus*.

A shaly bed sometimes occurs which abounds in *Spiriferina Kentuckensis* and remains of *Crinoidia*, including *Zeacrinus mucrospinus* and *Z. acanthophorus*. No. 90 affords a good building rock and abounds in fine specimens of *Campophyllum torquium* O. & S. Just beneath No. 96 and in shales (No. 94) occurs a very pretty *Conularia*, which in Missouri has thus far been only obtained from this horizon and at Kansas City. I have obtained the same fossil from upper coal measures of Montgomery county, Illinois. No. 96 is easily recognized by its peculiar type of large fossils. Similar species in this rock seem larger than where elsewhere found. *Producti* are abundant, also several species of *Bryozoa*. No. 98 forms rugged mural escarpments in the Kansas City bluffs. Brachiapod fossils are the most abundant. In my notes I have named *Syntrilasma hemiplicata* as one of the fossils found, but at many visits I have failed to find it; I therefore think it must be a mistake. *Syntrilasma hemiplicata* is abundant in No. 110, in Missouri bluff of Platte county, and in some beds at Eudora, Kansas. *Meekella*

striato-costata is sometimes abundant. That rare fossil and fine *Chonetes millepunctata* Mk. I have from Kansas City. The only other locality I know of is at Centralia, Illinois. Its exact horizon at Kansas City is unknown, but is probably No. 91.

MINERALS.

No important ores are formed in quantity. Zinc blende has been obtained in several places in the southern part of thecounty, but only in small quantity. *Barytes* (sulphate of Baryta) has been obtained from Nos. 74, 78 and 100. Handsome forms of calcites of the varieties nailhead spar, dogtooth spar and other forms have been obtained at Amos' quarry. Beautiful acicular crystals of arragonite I have also obtained from the same place.

THE ROSEDALE COAL VEIN.

Dr. J. Thorne sends the following item to the *Kansas City Journal:*

The Rolling Mill company at this place are now sinking a well for gas. The present depth is three hundred and forty-five feet. The following is the result thus far:

Surface dirt	23
Limestone	40
Soapstone	180
Limestone	8
Coal	3
Green shale	20
Black slate, Gas	6
Soapstone	20
Black slate, Gas	8
Green shale	20
Limestone	1
Coal	5
Soapstone	11

Thus we find a good deposit of coal three feet thick at a depth of two hundred and fifty one feet; at two hundred and seventy-four feet, gas with a pressure of seventy-five pounds to the inch. This burns with a clear flame, and is almost without smell. At three hundred feet we find more gas with a still heavier pressure; at three hundred and twenty-nine feet we have coal five feet thick; this is of good quality. You should remember that the well was started for gas; no coal was expected. The contractors, Swan Bros., are men of large experience in their line of business. They have the most complete and elaborate test machinery which science gives to determine the character of material they go through, and the facts and figures above given from the books of Mr. C. B. Swan are as reliable as any test can make them. Thus we have working beds of good coal eight feet in thickness within two miles of Kansas City.

—Geologists and botanists will be interested to hear of the publication of the third and concluding part of the work on the fossil plants of Switzerland by Professor Heer, the highest living authority on such subjects. This forms an appropriate continuation to the work on the fossil flora of the arctic regions by the same author. The fifth volume of the latter work is in press, and will contain an account of the fossil plants discovered in the Grinnell Land during the recent arctic expedition, and also the miocene flora of the Sachalin Island and the fossil plants of Nova Zembla.

—Recent investigations on the mean density of the earth, by Messrs, Cornu and Baille, show a value of 5.56—somewhat different from that which has hitherto been generally accepted.

CORRESPONDENCE.

SCIENCE LETTER.

PARIS, June 20, 1878.

Dr. du Saulle, of the Bicêtre hospital, estimates the number of epileptics in France at 40,000; one-tenth of these only are patients of asylums. Independent of these statistics, many families carefully conceal those of their members afflicted with the disease. As a general remark, an epileptic can be as intelligent and as reasonable as a person enjoying the most robust health. Not only is epilepsy not incompatible with the exercise of the intellectual faculties, but it has affected very great men. Julius Cæsar, Petrarch, Newton, Mahomet, Peter the Great and Moliere were epileptic. An occasional lapse of memory, the passing vertigo, alone betray the presence of the disease. The individual may be occupied with his ordinary affairs, enjoying apparently excellent health, when he suddenly turns pale, pauses a little, looks surprised, with eyes fixed, rests motionless from four to twelve seconds, heaves a sigh and finishes what he may have been speaking about; he has not fallen, has neither seen nor heard anything — he had simply absence of mind. At a whist party, a player suddenly drops the cards from his hands, and after a few seconds of immobility, resumes the game. Others may remain agitated and incoherent for hours. Dr. du Saulle draws attention to the disease from a medico-legal point of view, and asserts, the law very frequently punishes as criminals those who are the unconscious sufferers from epilepsy. A young man in a restaurant suddenly commences to whistle, undress and to brush his clothes—he is considered worthy of confinement. A lady distributes to the passers-by some money, her prayer book, her gloves, her umbrella, her bonnet—the crowd believes her to be drunk. Returning to consciousness, she seeks refuge in a cab. A philosopher rises from his work-table, and in the course of half an hour, makes and unmakes his bed; a millionaire solicits charity in the

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street; a soldier carrying dispatches, suddenly unsheaths his sword and attacks all persons within his reach. It is while in this state of access, that the afflicted kill wives, children, and those most tenderly loved, and that hallucinations of a religious nature are most frequent. When epileptic attacks are permanent, there is less danger for society, as the patient must be confined; the "fury" stage is terrible to witness; the afflicted is at first sad, then gesticulates, foams at the mouth, threatens, yells, strikes and bites; attacks the first person within reach, or beats himself against a wall. The crisis terminated, extreme prostration ensues. There is a category of epileptics who are only eccentric, immoral, extravagant, or wicked at fixed epochs; who commit the same acts and obey the same impulses, as if set in motion by machinery. Alcoholic epilepsy is varied and irregular, and is recognized by hereditary attributes. Criminals and vagrants often simulate epilepsy; when the latter is real, the attacked invariably becomes pale and devoid of sensibility—indications that cannot be imitated; the eyes are convulsed upward, the body is rigid as a bar of iron, and the teeth firmly clenched; foam comes to the lips, often stained with blood. Dr. du Saulle asserts, that epilepsy can be suspended, and the epileptic disarmed, by a bromide of potassium treatment. French juries are more and more attaching weight to medico-legal evidence, when in presence of a case of abnormal crime, and the accused possesses satisfactory antecedents.

A recent explosion of a fulminating factory in the most central part of Paris, naturally raises the question, "What is a fulminate, what is its chemical composition and explosive properties?" The first fulminate was prepared in 1774, by Bayen, an army apothecary, from mercury. In 1788 Berthollet obtained it from silver, and applied it to military purposes. But as the slightest shock or elevation of temperature caused it to explode, its use was limited to fire works. In 1800 Howard, mixing saltpeter with fulminate of mercury, obtained a practical detonating powder. Fulminate of mercury is prepared by adding nitric acid and alcohol to mercury, and heating the mixture in a vapor bath till yellow-white crystals are obtained. Fulminate of silver is similarly obtained, only silver replaces mercury. Both powders are very explosive; the slightest friction is dangerous, hence, why they are touched only with spoons made of paper, or the softest wood. Chemically, fulminate of mercury is a combination of cyanic acid and the protoxyd of that metal. How does it come that cyanic acid possesses so terrible an instability? Science cannot explain the promptness of decomposition; all that is certain is, that the elements of the acid, cyanogen and oxygen, are gaseous, and when the salt or powder decomposes, they liberate an enormous quantity of gas suddenly formed, the accompanying heat increasing the expansion. Common gunpowder is but an assemblage of kindred substances, which in decomposing are almost transformed totally into gas. Science cannot explain why the chlorates and picrates are equally as dangerous as the fulminates. To these must be added nitro-glycerine and dynamite, the latter being only nitro-glycerine diluted in an inert substance. These matters are more explosive than

gunpowder, and fulminate of mercury possesses the greatest shattering power of all. The latter is the material employed in those partially dangerous playthings, fulminating peas, that crack when walked upon; or detonating bombs, that explode when thrown against a wall or in a flag. The Cossack bombs, or common cracker of evening parties, consist of two narrow slips of parchment, between which is placed a morsel of the mercury, mixed with a few grains of sand or pounded glass: when the ends of the parchment are pulled in contrary directions the rubbing of the sand or glass against the fulminate provokes an explosion. The paper priming for children's pistols is merely a mixture of fulminate with with saltpeter or gunpowder dust, coated with gum to keep off damp and imprisoned between two atoms of paper. The capsules for rifles and fowling pieces, are similarly composed; the matters are made into a paste to allow of being worked; then passed though a riddle to break up the paste, and lastly agitated or whisked in a bottle till the paste divides itself into tiny balls of a determined size; these balls are dropped into trays containing each five hundred copper capsules, after which a globule of gum varnish follows, to protect the fulminate against humidity.

Dr. Fabre has investigated the allegation, that miners are peculiarly sufferers from anæmia, or impoverishment of the blood. In this disease the individual is pale-looking, not on account of the volume of the blood being diminished, but owing to a decrease in the number of the red globules of the blood, and which constitute the richness of that fluid. If miners be pale, observes Dr. Fabre, the cause is to be sought, not in anæmia, but in a diminution of the coloring pigment of the skin. In a coal mine, the quantity of oxygen is less, and of carbonic acid greater, than in the external atmosphere, but the toxical gases, owing to improved systems of ventilation, play no more a vitiated role. In the coal mines of Commentry, horses have been employed fifteen years, and no difference has been found in the globules of their blood, as compared with horses over ground. Dr. Fabre concludes that the volume of the red globules is smaller, and their appearance paler, in the case of miners, than with ordinary individuals. As to the longevity of miners, the Doctor states, that from among two thousand pitmen who had worked uninterruptedly from twenty to thirty years, fifty-two were above sixty years of age; eighty-eight between fifty and sixty, and one hundred and forty-seven between forty and fifty.

However, anæmia is a malady in a sense modern and peculiar to a town life. "Upon twelve individuals" observes a leading practitioner, "residents of a city, I find nine who are anæmical." In Paris, the favorite prescription with doctors for patients who "are out of sort," fatigued or suffering from depression, is bark, iron preparations, underdone beefsteaks and country air. The air of the fields is salubrious and a practical tonic. There is much truth in the remark, that if the rural population did not come, little by little, to renew that of the town, the denizens of the latter would die out, and cities become only vast cemeteries. Air is the best of aliments; it is the true *pabulum vitæ;* we choose our food, wine and

water, but for air, we have to accept it as it arrives. In cities, the quarters renowned for good air are eagerly sought by those who can afford it, many preferring that which is bracing. But the latter is not necessarily pure; the quantity is often confounded with the quality. Chemically, air is said to be composed of nitrogen, oxygen, a little carbonic acid and a trace of ammonia; philosophically, the composition includes a variety of additional matters, held in suspension, animated or inert. The atmosphere is a vast receptacle, where gases and every kind of light residues float, as grains of dust swim in water; there are the dead bodies of infusoria, dried pus, the pollen of flowers, and the germs or spores of epidemics. Now as the impurities of a stream fall little by little to the bottom, so the deleterious atoms in the air gravitate to inferior zones, where man, riveted to the soil, has incessantly to inhale them. Some of these substances are harmless, others poisonous and that can produce serious maladies. We unconsciously swallow millions of microscopic plants. The microscope has revealed in a single drop of water which had passed through a portion of the atmosphere, the presence of half a million of germs or spores.

In addition to these, there are the residues of our respiration, the impurities of our cutaneous secretions, and the remains of our dead cells. Ehrenberg has discovered in the air more than 200 different species of infusoria, the atmosphere of some rooms is impregnated with arsenical emanations; that of printing offices, auctionary and of sick chambers, with species of transparent and irregularly-shaped animacules. The "morning air" of a city is a museum of poisonous curiosities, caused by the dusting of houses and the cleansing of streets; happily our lungs are a capital filter, and arrest even matters too minute to be detected by the microscope. Pure air will not reflect a ray of light; expire across a ray of electric light, the latter will be cut as it were by a black space, as the expired air having been filtered by the lungs, contains no impurities, that is reflecting atoms. In pure air, putrefaction is impossible; it contains no fermentation germs; air in a chamber is chemically pure when after a few days of absolute calm, its suspended matters have subsided. In this condition, Tyndall says, substances will not decompose. The lungs receive daily 10,000 quarts of air; judge then the impurities that must pass through the cells, of the struggle between these foreign matters and the globules of the blood, to secure the oxygen. Now this struggle to acquire the requisite dose of oxygen to consume our food, represents all the difference between robust health and disease. The strong suffer least; but what benefit is the most substantial regimen, if good air, that is, the supply of oxygen, is wanting in the economy. What is gained by filling a furnace with fuel, if air be insufficient—if the stove cannot draw? No suitable supply of oxygen, no digestion; and no digestion, no assimilation of food is possible. Hence, why change of air frequently proves the best of medicines, and why a run to the seaside or a mountainous country restores a lost appetite. When a citizen enjoys a day's outing in the field, he returns home with the hunger of a wolf, and sleeps as sound as the blessed. Hence, too, the importance of holidays, of trips and of tours.

In cities, an elevated site is not necessarily a healthy one; the wind may waft across an over-populated quarter; generally a southwest position is to be preferred, as the air coming ocean-wards is purer than when it arrives from the northeast, over the continents. Again, sea air is exciting, and that of mountains tranquilizing; at the sea side a stony beach exercises a different influence from a sandy one.

Intense attention is given at present to the science of acoustics and electricity. The new concert hall at the exhibition, is a model, as respecting the laws of sound, and, as for electricity, not only are public buildings now illuminated with this agent, but also avenues and streets. At the present moment men are laying down wire in gutta percha tubing, to illuminate the Champs Elyseê and parts of the Bois de Boulogne for the 30th, by means of the electric light. M. Reyner has perfected an ordinary lamp for electricity, that contains the germs of a great innovation; it is equal in power to an ordinary Carcel lamp, and the difficulty has been conquered for its lighting; it divides the light, and can shade off rays for one or two rooms. Capt. Trére, of the navy, has invented an electric break, by means of which, on touching a button, either in his cabin or on the quarter-deck, he can instantly control the speed of the engines—the electric current commanding the valves. This is only an application of the new compressed air-break for railways, and which is becoming common in France. In running at full speed, the engine driver can, by touching a handle, bring the train to a sudden stop—the shock is next to insensible. Visitors crowd to study the apparatus in the exhibition, after being astonished at its application to the train that has conveyed them.

"ANTRUM."

EDITOR WESTERN REVIEW:—A recent sad event has induced many persons to ask, "What is the antrum, and why and how is it subject to disease?" *Antrum* means a "cavern." In anatomy it applies to certain cavities in bones, the entrance to which is smaller than the interior. "*Antrum Highmorionum*" (so named from being discovered by Dr. Highmore) "is a deep cavity in the substance of the superior maxillary bone (the upper jaw) communicating with the middle meatus of the nose." It is lined by a prolongation of the mucous membrane which lines the cavities communicating with the nose. This "cavern" is situated from one-eighth to three-eighths of an inch above the extreme point of the fang of the second bicuspid and first molar teeth, the intervening bone being quite cellular.

Disease of the antrum may occnr from an injury to the cheek bone, or either of the teeth above named; possibly from some chronic affection of the nose. More frequently, however, it originates from one of these teeth becoming decayed and diseased at the root. When the peridontium (lining membrane of the tooth's socket) or the pulp of the tooth becomes ulcerated, and the pus is prevented from discharging through the pulp canal of the root, it will necessarily find vent in some direction; usually through the alveolar process and gum—forming an

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alveolar abscess, ("gum boil") Not infrequently, however, the inflammation and consequent pus find a more ready passage through the cellular tissue of the maxillary to the antrum. If confined to these parts any length of time necrosis (dead bone) follows, and sooner or later produces tumor or cancer. In the earlier stages of diseased antrum, especially when originating from a tooth, the treatment and cure is simple and comparatively painless. It is only necessary to have an opening to the cavity through the alveolus and maxillary, either by extracting the diseased tooth or by an artificial aperture. This passage must be kept open by means of *tents* until the disease is entirely eradicated and new and healthy tissue takes its place. The treatment consists in injecting the cavity with a mild antiseptic, thoroughly washing out all accumulation of decomposed substance, once or oftener every day, until healthy granulation is completely established.

Just here it is important to repeat, and urge upon the community, parents especially, the fact that the first molars of the permanent teeth come in when the child is *six years of age*. Also that, they are the most important in preserving the contour of the mouth, and in masticating the food. They are almost certain to begin to decay when the child is from eight to twelve years of age, and if not promptly filled are certain to give great pain and trouble. They should never be extracted while there is any possibility of saving them by suitable treatment and filling. Parties who have suffered have urged me to elucidate this subject, as a warning to intelligent people not to procrastinate the important matter of preserving the teeth. Nothing but prompt, constant and scientific attention will save them. Procrastination invariably increases expense and depreciates your teeth, health and beauty.

A. H. TREGO, D. D. S.

INTERESTING NOTES ON FORMER CYCLONES IN WESTERN MISSOURI.

EDITOR OF WESTERN REVIEW OF SCIENCE: I have just read, with much interest, the article in the June number of your REVIEW on the Richmond cyclone. Pardon me for saying, in advance of what I wish to communicate in this letter, that it should be a matter of general regret that scientists employ the term Cyclone, when they have at hand so forcible and expressive a word as the Saxon, whirlwind—a word so intelligible to all classes of people, and which so admirably conveys the idea. It does not appear from your article what were the track and course of the whirlwind or tornado which passed over Richmond in 1869. My recollection is, that it was in June of that year. On the same day, in the evening, and I think closely contemporaneous with the storm at Richmond, a violent wind-storm, followed by hard rain, passed over Liberty, going from northwest to southeast. Whether the wind which passed over Liberty swept down the Missouri river and united with some other current to form the tornado at Richmond, or was the result of atmospheric disturbances at or near Richmond is, of course, with me a matter of conjecture.

There was a fearful wind, sometimes called the "whirlwind" or "great

hurricane," which passed about forty years ago over the Missouri river, near Blue Mills Landing, in Jackson county, into the river bottom of Clay county, between the bluff at Liberty Landing and the bluff at Missouri City, doing immense damage to the forests. The trees were so blown down that for years after, in the bottom below Liberty Landing, it was impossible to go through it on horseback. It became a lair for wolves and sport was had for a long time in hunting them. Probably this was more than forty years ago. It was long before my recollection, but when a child I often heard it spoken of. R. A. Neeley, who lives in this county, near Missouri City, could give you details. He has a very remarkable memory and retains old events with great freshness. I do not know enough about that wind to say whether it was a whirlwind or hurricane.

In 1844, the farthest point to which my recollection of meteorological events extends, a hurricane swept over the same territory as in the "great hurricane," but it was not so violent. I remember it distinctly. The facts within my knowledge and observation lead me to the conclusion that the area of country between the bluffs at Liberty Landing in this county, and Lexington, is subject peculiarly to violent winds, whirlwinds and hurricanes.

In 1862 or '63 a very violent wind swept over the northeast portion of this county, passing between where are now the villages of Kearney and Holt, and I have heard of violent winds since passing over the same line. But the winds that have swept over the northwest portion of Clay have never been so destructive as those over the southeast portion of it. Thinking that you will wish to continue your investigation of the whirlwind, I have deemed that the communication of the above facts to you might be of service in reference to the question of localities where they are likely to occur.

Very Respectfully. D. C. ALLEN.

LIBERTY, Clay Co., Mo.

KANSAS CITY INDUSTRIES.

This is the only place I have seen, the last six months, where nobody complains about hard times. Every body appears to thrive, and the city grows and prospers. It is probably due to the fact that it is mainly a market and shipping point for the necessities of life, such as grain, cattle, provisions, and clothing, while her manufacturing interests have not yet recovered from the measles, and, for that very reason, have not been affected by the maladies of dropsy, gout, and "katzenjammer," which distinguished the manufacturing centers and wings of this country. Still, there are some branches which exhibit much pluck and life.

Several coal companies have their headquarters here. The total in and out of coal last year amounted to 3,600,000 bushels. The companies are not a unit, and coal sells at eight to nine cents. Rusty coal, from Fort Scott, and the Joplin coal, the best of all, sell at from ten to eleven cents.

The Kansas City Rolling Mills, of Rosedale, use exclusively Joplin coal—that is, coal mined at Pittsburg and Carbon, on the Joplin railroad, in Crawford county, Kansas. The mills produced the last seven months 18,900 tons of rails.

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They consumed, in making the same, 18,170 tons of Joplin coal, which much resembles Indiana block coal.

So far as her resources and local interests and influence may warrant it, her iron works and shops do and will do well. But she must beware not to repeat the great blunder of St. Louis. Competition runs so high that all out of place establishments must be brought to the fuel; generally the metal, too. The millions thrown away in Carondelet or South St. Louis, if applied to the improvement of the Missouri River transport between Kansas City and St Louis, would have secured the preponderence of St. Louis over Chicago in regard to shipments from this point.

The great iron manufacturing interests of St. Louis must needs locate upon Illinois coal; those of Kansas City upon Crawford and Cherokee county coal—near enough to benefit the great commercial interests of both. One sentence will explain the matter: No coal, no Pittsburg; no Pittsburg, no worthy competition. Several foundries and machine shops are doing well, and the building of new shops is contemplated.—*Correspondence of the Engineering and Mining Journal.*

METEOROLOGY.

A NEW VIEW OF THE WEATHER QUESTION.

BY ISAAC P. NOYES.

The following remarks are respectfully offered in the hope that they may tend to throw some light upon the further solution of the weather problem.

In connection with the facts and comments thereon, theories will be advanced on the basis of the facts as at present known to us, not with the idea that they will be new to the initiated, but rather with the hope that they may better serve the object of the article by drawing attention to this interesting problem, and in a general way reaching some minds that by other means might not be attracted to it.

The weather by many seems to be regarded as among those things that are "past finding out," yet it would seem that as familiar as the knowledge of natural phenomena is now to the world at large, it should no longer remain quite the great mystery that it has necessarily been in the past. The simple trouble in the past, in this department of science, was the want of the proper medium by which to collect the facts. This subject has had very earnest apostles, but what even can the most earnest devotee do when the very material on which he would construct his laws is beyond his reach. After much controversy on this subject and discussion by such men as Halley, Espy, Henry, Butler, Loomis and others, the great want which they labored for and knew to be absolutely necessary, was finally supplied by the United States Signal Bureau, under Gen. A. J. Myer, of the United States Army. Of course such a bureau has its enemies, and steps have at times even been taken to cripple its actions, and perhaps some would cut off all appropriations for it and leave it among the things of the past, but such a

course it is to be hoped will not be seriously thought of by any controlling element, at least so long as the general treasury can be made to meet the modest demands of so happy a combination of science and practibility. Only by such a large and simultaneous collection of daily facts as this office is year by year patiently collecting have we been able to obtain valuable material toward completing the solution of these questions, and our hope for still more and more light upon this important question is in maintaining such a bureau, and that it may be able gradually to extend its influence to more and more new territory whereby it may be able to do better work and obtain more reliable results, and enlighten mankind with the mysteries that preside over the natural phenomena that govern the weather, making them familiar with its workings, whereby they may turn this knowledge to practical account.

STATEMENTS AND COMMENTS.

The first question that seems to present itself in this relation is, "What makes the changes in the weather?" Years ago certain general facts were known about the changes of the weather. Dr. Franklin, it is said, first ascertained that "all storms travel toward the north-east." Though this fact may not be exactly true, it shows that in his time they had some idea of how a storm travels. Then it has also long been known that a storm travels in the "eye of the wind," and that in order to clear away, the wind must come out in a certain quarter; these and many other things were known, yet there was much that could not be known at that age—that must wait for an advanced condition of things to be explained more fully, while such absurd notions that the moon effects the weather by driving away clouds, etc., were also held. This notion about the moon affecting the weather seems to be difficult to eradicate, at least from the minds of the people at large. They claim to know what the weather will be for the month to come by certain signs about the moon, and they believe that the moon has power to drive away or even collect clouds whereby great changes in the weather are brought about. The only possible affect that the moon could have upon the weather would be from its reflected heat from the sun—thereby working in this manner as the sun does, but this heat is so infinitesimal that if it should be concentrated for all night long upon a given locality it would not be able to develop a cloud as big as one's hand.

I. The first source of the weather, as to changes, conditions, etc., is the sun. This, though a common and well-known fact, is simply enumerated with other facts in order that they may here stand, as they act, together.

II. Is the rotation of the earth on its axis.

III. The motion of the earth around the sun.

IV. The parallelism of the earth whereby the light and heat of the sun is made to shine on the earth's surface alternately more on the North pole than on the South pole.

V. These various conditions ever changing their relation to each other have for one of their results what we term the weather.

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VI. The text books on natural philosophy tell us that "currents of air, or winds, are produced by the unequal distribution of heat over the earth." The facts gathered by the Signal Service Bureau substantiate the statement; but then very little is gathered from this single statement by which to understand the weather.

VII. When an effect is noticed it is our duty to ascertain the cause. The inquiring mind seeks to get at the most plausible cause. We cannot alter the facts to make them accord with what would seem reasonable to us—we must take them as we find them and build up our theory accordingly.

VIII. Mere meteorological tables taken without relation to one another are of very little account. They form a cumbersome material very awkward to handle. The system now in vogue of daily observations taken, at the same moment of actual time, is far more valuable and reliable as to facilitate the operations of working out the great weather problem.

IX. We should endeavor in this, as in all our labors in behalf of science, to separate whatever is merely accidental or local from that which is general and forms an essential element in the grand laws of the universe.

X. It is the practice of the Signal office to publish three maps a day, but only one, that based upon the observations taken at 7:35 a. m., receives a general circulation. The second and third maps, more specially designated for scientific purposes we presume, are founded upon the observations of afternoon and midnight. More observations the better, for the changes are sometimes so rapid that an observation taken at 7:35 a. m. would give no idea of the actual condition of the weather for the best part of the day.

XI. Some localities are dry and some wet. In some, changes from one condition to the other are rapidly taking place, while in others one condition or the other is more or less protracted. The question is, Why is this so? It would not seem that any one thing was the cause. Nature obeys the strongest force. We see this in all things. The strongest, however, is more or less influenced; it however predominates; yet not without more or less compromise.

XII. The wind from the South, it is obvious, must be warm, while that from the North is cold. As a wind partakes of these elements it will be either warm or cold. Yet at times there are apparent exceptions to this. Sometimes in the winter we have quite a cold southerly wind, but this it will be found to be because what is to us locally a southerly wind is generally an easterly or westerly wind partaking more or less of northern influences.

XIII. All winds from all quarters, that is, all kinds as to force and moisture. The quarter itself not the governing influence only as to cold or heat; for example, more especially in the Atlantic States an easterly wind is dreaded, and thought to bring peculiarly disagreeable stormy weather, yet it does not always, and apparently it is the merest accident when it does. Some of the finest weather we have in this country we have with an east wind, and that, too, without resulting in a storm.

XIV. It is sometimes locally hotter at the North than at the South, because

it is *generally* hotter at the South. This may seem paradoxical, yet it is plainly evident from the facts that bear upon the subject depending on the condition and location of the low barometer center.

XV. In this matter of the weather we need to give our attention to all the laws respecting it, but more particularly to *observe the general rather than the mere local forces*, for the general force will prevail over the local—swallow it up as it were—sweep it along with the tide.

XVI. Change in weather. The great factor that makes the change in the weather is what is termed "low barometer." The great source of which is evidently the variable concentration of the sun's heat upon certain portions of the earth's surface. This fact has long been held, and like many other points in natural phenomena has been controverted and ridiculed, but the later observations by the United States Signal office seem to verify it and place it beyond dispute.

XVII. It is an undisputed fact that there are certain localities where the barometer is much lower than at others;

XVIII. And that the winds from all quarters move toward the centre of *low*.

XIX. Though the winds are in the direction of *low* they do not at all times blow with equal force toward this center. Sometimes it blows the hardest from one direction and sometimes from another, depending upon local conditions.

XX. In opposition to *low barometer* is *high barometer*. So on the weather maps will always be indicated these two extremes.

XXI. There are a great many of these centers of high and low barometer.

XXII. There are large and small centers of high and low barometer.

XXIII. These centers are ever changing.

XXIV. *Low* travels from West to East and generally on a line somewhat North of East, as will be seen by a daily observation of the weather maps. At least this is true as to land. What it is on the ocean we do not as yet know, though there is some evidence that under certain conditions the direction is reversed. We have few facts to prove either that it does or does not, and what little authority there is on the subject would seem to convey the idea that there was no difference in this respect from the land and the sea. Yet if one will follow up the course of *Low* as presented on the weather maps this would not seem unreasonable to believe. We trace a low along the land till it enters the ocean. Then if we will bear (XXV) in mind the fact, that other things being equal (and the *other things* are local forces) the wind will travel in a straight line from *High* toward *Low*. This is both natural and in accordance with the facts of the weather maps, though it has been stated by some that such is not quite the case, rather that the wind is between the two, that is if you stand with your left hand toward *high* and your right hand toward *low* the wind will be directly in your face. The natural forces and the facts of the weather map will not warrant any such a supposed law. The undoubted law is that the wind from all quarters will take the most direct course possible toward the vacuum *low*, and it seems obvious that the wind will take a more direct course on the ocean than on the land, for

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here it is all one element—water—consequently there will be less of local forces to detract it. This being the case, even though we know not exactly where *low* is, we can by noting the direction of the wind tell in which direction it is and trace its course.

XXVI. Now in the United States *low* disappears off of the coast, generally, though not always, up in the north-east. By some it is said to be lost in the sea. The wind then begins to blow to the west—north-west—north—then finally around to the north-east. About this time a new *low* sets in down off Florida. In no particular locality, but in this general neighborhood, and at times the movements of *low* are so regular as to present itself in the neighborhood of some one locality on a certain day for weeks, varying in its course but leaving its tracks in part at least over the same ground.

XXVII. This being the case it would seem that low barometer under certain conditions obeyed the other great laws of nature, of the course of our earth around the sun and the planets and comets in general, and that when in *connection with land and water* as on the east coast of the United States (and perhaps on the west coast of continents also) it travels in ellipses; *i. e.* on land generally traveling from west to east and perhaps the same on the sea, but in the immediate vicinity of land and sea from east to west.

XXVIII. Of course we have not the facts to prove this, and it seems contrary to the general fact that *low* travels, at least on land where we can trace it from day to day, toward the east, or the sun, yet the course of the wind along the east coast of the United States, as traced above, would seem to carry with it some weight that *low* somehow or other was differently influenced by the joint action of land and sea to what it was when directly on one element. We know not the facts in the case; we can only infer this—attempt to interpret the unknown by the known. It may be many years before it can be actually proved; yet as an aid toward solving it, it would seem well to have some staunch, swift and able steam vessel to endeavor to prove it by being in readiness up in the north-east when *low* was just moving off the coast, and follow the center of the storm as close as possible. Judgment should not be based on simply one experiment, but it should be followed up a number of times, and even by a number of vessels, that we might have as much information on the subject as it would be possible to obtain.

XXIX. We cannot at present make ourselves familiar with all the changes of low barometer. We have no information from a greater portion of the land surface and can at present have nothing from fixed localities at regular stated intervals from the vast expanse of water, that make up the greater portion of the globe. At some future day, however, we may be able to establish mid-ocean stations,* when we can greatly further our studies of this beautiful system whereby our earth is made habitable. We, however, do already understand enough to see the passing wisdom in having this constant shifting of the areas of low and high barometer, whereby blessing in the form of grateful showers and fruitful sunshine is made continually to visit different portions of the earth's surface—

*A plan for this was suggested by the writer in a paper published April, 1876.

making it more habitable for man—generating the "clouds that drop fatness," and following this up with freshness of air and sufficiency of heat to propagate and maintain life.

XXX. The "first cause" in this department, putting aside heat, etc., is low barometer. Whether we have all the information on this particular point that we can ever ascertain we know not, but one thing we do know, that the lightness of the air at *low* is a fact, and that where *low* is there will be the storm center, and when this passes away and the barometer indicates *high* we will see the sun shine and we shall have what is understood to be pleasant weather again.

XXXI. What makes the conditions we term *low* is not so easy to comprehend. With our present knowledge it would seem more reasonable to us to have low barometer in the vicinity of the warmest places, but (XXXII) a low barometer does not go with a high thermometer, at least so far as we can detect. We have low barometer in regions of perpetual ice. Though at present we cannot comprehend why this should be we can see a passing wisdom in having it such.

XXXIII. The movements of low barometer are much the same in winter as in summer, that is in summer we have northerly winds and in winter southerly winds; though in the winter we have a prevalence of northerly winds and in the summer a prevalance of southerly winds, showing that as the wind is always toward the low barometer that the conditions of low barometer are generally in a higher latitude in the summer than in the winter (*i. e.* north of equator and the reverse south) though these conditions are not confined to localities of latitude.

XXXIV. A theory as to *low*. First, *low* as marked on the weather maps and as generally understood is only relatively low, and so with *high*. A *low* may sometimes be really higher than *high* sometimes is, and the reverse. Then these change as to latitude. Generally throughout the United States 30.30 inches high, and 28.30 very low.

The sun shines on the earth. We may call high or low barometer normal, it matters little so long as we take some definite starting point. In this paper let the whole area of the United States be represented as *high*. In this condition we will have bright sunshine and clear sky. If the earth were one vast plain, and the sun a fixed point of heat, and no water present or near, we should continue to have a sameness of weather for month after month and year after year. But the surface of the United States is not, nor is any portion of the globe generally made up on this basis. There are, however, local spots on the earth's surface answering partially to these conditions but not wholly. The mere condition of the earth's surface in certain localities in flat-plain-like without certain factors to cause, or with certain factors that prevent change, but the sun does not remain stationary, so even though the earth's surface be favorable for a normal condition in itself, the constant changing of the sun's heat and its regular periodical withdrawal would necessarily make changes from time to time. The earth's surface fortunately is irregular and interspersed with much water in addition to the great oceans. The sun must shine over the eastern portion first. The surface of the earth at this point will begin to be heated; this will expand the air immediately

above it causing it to ascend; cooler air will rush in to fill up the vacuum, or perhaps better to prevent it. From the time the sun is relatively to a given spot 45° high in the east to 45° in the west, the greatest heat of the day will be concentrated on that spot. In addition to this the heat of the sun will gradually begin to evaporate the water and form clouds. These obeying the natural law of their peculiar construction will float in the air; showing that they are in this state balloon-like and lighter as a mass than what we call air, even though they have apparently a far more materialistic form. A current of wind is gradually established toward the most heated portion. Clouds are not only being developed here but all over along the path of the sun. The sun will move along on its course, the earth will retain its heat; the water present will have a propensity as it forms in clouds to cool. Perhaps the first day will not make any great change, but after a few days some one point or circuit, say of a hundred miles, becomes established, from the attraction of peculiar local forces and other causes, whereby this air is heated and becomes lighter than its surroundings. Though night comes on and cools the air, the whole of the earth is subject to the influence of night, making the different portions of the earth relative in this respect. So when the sun rises on a new day he as it were takes hold of the near or eastern end of the track where he left off the preceding day. His rays are naturally concentrated where it is the warmest, yet beyond any area of heavy clouds. Of course as there is an effort on the part of the sun to heat there is on the other part of nature a disposition to cool. Clouds are the while developing and even becoming attractive and condensed in themselves, etc.

The process advances till a quantity of clouds or suspended moisture is formed; the more the moisture the heavier the clouds, From all points currents of air set in whereby these clouds are gathered together. This gathering together of clouds and wind produces a number of effects. The winds are from all quarters and therefore of all degrees of temperature, but on the whole the tendency from this is to cool the atmosphere. The presence of the clouds is another tendency to cool even though they become a mantle over the earth for retaining heat. So these facts if nothing more would cause the locality called *low* to be reduced in temperature. The clouds are full of rain and they will precipitate. The sun the while has moved along to another point, where there are less clouds, heating that and going through with the same process say at an interval of five hundred or a thousand miles, more or less, depending on locations causing an attraction of wind and clouds to that spot. The next day the sun rising in the East it will more or less heat spaces to the east of these localities, and perhaps a little north of south, thereby causing, as it were, the centers of *low* to move to the eastward—at least for land. Perhaps, so far as we know at present, the centers of *low* may encircle the earth though there is some evidence (as referred to above) of the sun heating portions more and more to the south of east and gradually working to the south—south-west—west—north and north-east and so around in a circle or circular course—at times larger or smaller. These points as

to the course of *low* at present, however, are not facts; this is only to suggest an account of certain facts seeming to favor it, but whether *low* travels thus or directly across the ocean as on land can only be ascertained by further and careful observation. *Low* is continually on the march generally toward the east, unless there be local exceptions, this much is an admitted fact.

It is said that "a vessel bound to the westward meets *advancing* areas of low pressure, and the observer finds that his barometer falls and rises again more rapidly than it would were he on shore, while an observer on board of a ship bound to the eastward has just the reverse experience."—(Circular Signal office 1878). This if anything would seem to show that water heats and cools more readily than the land and that the sharpest grades of temperature would be on the east of the side the sun approaches the center of *low*. So from the barometer an expert could tell, if he had no other means, the general course of the vessel—eastward or westward. Yet at the same time this does not necessarily prove that *low* does not travel in ellipses. This, however, would seem to suggest that the navigator, especially the officers of the ocean steamers, be requested to note the course of the wind in connection with the low barometer centers; by a careful note of this fact we might be able to determine something quite reliable as to the probable course of low barometer centers.

XXXV. The center of *low* is not the warmest point for various reasons. The generation and concentration of moisture tends to cool, to say nothing of the winds coming in from all quarters north as well as south. This being the case, it has been a subject of warm discussion on the part of some writers on the subject of the weather, Mr. T. M. Butler, for example, (in his "Atmospheric System," 1870) for this and for other reasons contended that the conditions we term *low* could not be thus caused. His idea was not that if *low* was caused by the concentration of the sun's rays on a given point that we could have *low* at places where there is the greatest heat. According to human ideas it certainly would seem that such should be the case, but it is also a law of nature that (XXXVI) the conditions of low barometer is not, at least often, associated with a desert or very dry places, and not at very hot places at the expense of cold places. Other things being equal, *low* will predominate where there is the most water, or at least where there is the most admixture of water, and the reason seems obvious. When there is no moisture, sure, the ground heats up quick, but there is no material for clouds there. The sun is all the while passing on, night comes on, and what was so hot during the day becomes very cool at night. Had there been clouds to center there the heat would have been retained; no heat is retained as a basis for the work of developing a *low* the next day. The process of heating has to be all gone over again. Evidently the best combination for retaining heat is a good interspersing of land and water.

XXXVII. Other things being equal, the *lows* would probably be permanent at the equator, but they are not, and as we become more and more familiar with the facts of the weather the more and more we see the wisdom of the Creator in having the various combinations of heat, the distribution of land and water, the

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inclination of the axis of the earth, etc., whereby the weather is equalized, tempered and changed.

XXXVIII. Mr. Butler, after discussing the question of *low* and saying what it was not, put himself on record ("Atmospheric System," page 381) that it was caused by "electricity." Such a man as he we know would not deal with such a thing lightly and say "electricity" in any wiseacre sense. It is not pleasant to controvert one much older in the service than yourself. Perhaps it is electricity, but Mr. Butler did not sufficiently explain his point, and now, for this world at least, he is beyond the power of the discussion of a topic in which he took such an absorbing interest. On this point, however, I would venture the suggestion that electricity itself may, after all, be nothing more or less than heat. Without heat there never could have been electricity; it seems to be only a higher or more subtile form of heat, as it were, bearing about the same relation to heat in general as ozone to oxygen.

XXXIX. Again Mr. Butler maintained that if there was what is now commonly called a "hole in the sky," that clouds must necessarily shoot up through this hole, and he offers quite a reward to any one who ever saw such a sight as a cloud—a scud—going heavenward This he seemed to think conclusive evidence against the theory that *low* is formed in the manner here referred to. The air may go up without taking a cloud. A cloud is only a mass of water combined with air—balloon-like. When a maximum point of moisture is reached the water re-falls to the earth. At a center of *low*, clouds are piling in towards each other; as they are thus brought together they are compressed in proportion to the force of the currents that brought them together and, as it were, the water is squeezed out of them as though they were so many sponges. Where is the air that also helped form them? It is not unreasonable to suppose that it rises towards the heat that is on the upper side of the clouds. So it does not seem inconsistent to believe the common and generally-acknowledged theory on this point—and it would seem very strange to see a heavy rain-cloud take an upward flight—especially when we know that beyond a certain limit the air becomes very rare and incapable of sustaining bodies of any great weight.

XL. It is a fact, however, that the lighter cirrus clouds are often seen moving above the lower and heavier clouds, and in an opposite way from the way the wind is blowing on the surface of the earth. This fact, if it proves anything, would seem to go to prove the "hole in the sky" theory, by showing that there are upper currents, as is also ascertained by balloons moving in another direction from the surface currents. This will readily fit the theory that the air does ascend over the spots called *low* and that the air is seeking to equalize the various forces whereby it exists.

XLI. This is, as it were, Nature's grand plan of ventilation and purification, whereby we have a bountiful supply of fresh air far beyond the demand.

XLII. *Low* travels eastward, at least as a general rule, or towards the sun. Did the sun rise in the west this would undoubtedly be reversed, and we should see storms traveling (generally) from the East towards the West.

XLIII. There is a common saying that a storm travels in the "eye of the wind," i. e., in the direction that the wind is blowing. This is true in some cases, but it must be seen that it cannot approach to the dignity of a universal law—it depends much upon the locality, and particularly upon the relative location of *low*. Along the Atlantic coast this is more true of a North-east storm than any other. There are cases where this for some localities may be true with a North-west wind, when a *low* starts in on the coast and takes a North-west direction. Such a storm center or *low*, however, bends to the East, and apparently goes to prove that *low* travels in circles or ellipses. Familiarity with the motion of *low* and the fact that its *general* course is towards the East, will make it a very easy matter to trace a storm and make us more skillful at forecasting the weather.

XLIV. On the maps the changes are marked *high* and *low*. *High* it would seem, according to the principles here treated upon, should follow *low*, and such appears to be the fact, although it would not seem to rank with *low* as an independent condition, but rather as an adjunct. We could have no *high* without a *low;* the *low* is the governing condition.

XLV. Can we ever have *low* under our control? It would seem not, yet we evidently can help in establishing centers for *low*, as in deserts, where there are naturally none, by planting trees and inducing foliage to develop, whereby moisture may be drawn up from the earth and what may be present in the atmosphere retained, thereby heat prevented from escaping through the night, etc.

XLVI. Where there is foliage the conditions *low* are more equally and extensively developed, and this leads to (XLVII) the conditions of storms that follow woodless countries. Where the woods are cut away we have great droughts and sudden and fierce winds and rains. As to rain, much depends on the extent of the area of barren soil. In all these changes many influences are at work, and we cannot make ourselves too familiar with the idea that the strongest factor is going to prevail.

XLVIII. When a storm is working up more or less moisture is developed according to the circumstances herein spoken of. If clouds are spread over a large extent of territory and *low* is not very concentrated the precipitation will be light. It is then that rain "comes down like mercy," and does so much good, as it has plenty of time to penetrate the earth, and therein lay up a supply against the seasons of drought. As foliage tends to accomplish this and regulate and equalize it, as it were, it would seem worth our while to heed it. The fact itself is known, yet many facts that we really well know are not fully appreciated until stern necessity presents them to the world in the most forcible manner and in the most powerful light.

XLIX. As has been remarked one *low* follows another at shorter or longer intervals. Again a condition of low may circumvent a place or locality, and then at times one place or locality will have an abundance of rain—rain almost every day for perhaps two weeks, while another will not the while have any; as it were one locality has rain at the expense of another. (See plate).

A *low* may start in on the coast of L and take a regular course toward the

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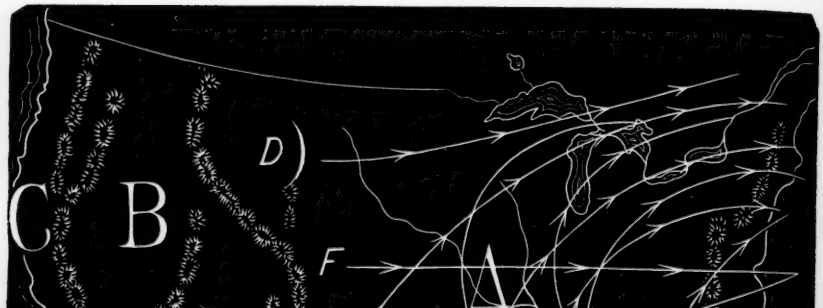

north-east; it may start in at G, take a more or less circular course, and thereby pass locality K, or start in H or I and travel to the northwest, leaving the Atlantic States without rain; or it may, separately or in conjunction with others, start at E, F or D and take a more or less direct easterly course to the Atlantic ocean. These lines illustrate the general course of *low*, but if the engraver should exercise his imagination to the utmost and make the lines so thick and intricate that they could not be deciphered, or lose their identity in multiplicity of directions, he could not give all the changes that are constantly occurring in the paths of *low*. One of the missions of the Signal Bureau will be to note the course of these *lows* and to see how they are associated with any particular season of the year.

L. In nature nothing is more marked than is this matter of rainfall that the strongest factor will prevail. Other things being equal the rainfall will be at *low*, but they are not, so we occasionally have an apparent exception to the fact that low barometer is the cause of rain. On the 10th of April, 1878, *low* was off in the north-west and extended over a large territory. The wind, as was natural, set in to the eastward, and under such conditions it does not move with the rapidity it does when *low* is concentrated, so under these circumstances the clouds were carried along very slowly. They were the while, however, growing heavier and being wafted toward *low*, but coming in contact with a changed condition of atmosphere on the border lines of *high* and *low*, precipitation took place, prematurely as it were, so that there was little or no moisture to precipitate when

the real center of *low* was reached. The strongest factor in this case was the coming in contact with a changed condition of atmosphere. This does not often occur and it would seem could only occur at such times as when such conditions here referred to meet. Yet this would prove, if anything, that clouds were being developed all over—more or less according to circumstances of moisture, heat, etc,, and that the condition *low* was simply a means of concentrating moisture over a given district. Such a condition as this may be difficult to prognosticate. It would be apparently the most natural to expect the rainfall at *low*. This, however, is a fair illustration of one of the many things with which the Signal office has to contend, at least at present; perhaps at some future time when the officers become more familiar with the mysteries of the workings of nature they may know better how to calculate upon the neutralizing influences of what may become under some circumstances, for the time being, the *strongest factor*.

LI. The United States is a fine field to study this subject, and it seems to be divided into three distinct systems; that east of the Rocky Mountains, A; that embracing between the Rocky Monntains and the Pacific coast range on the west, B; the narrow strip embracing between the Pacific ocean and the coast range on the east, C. Could we have the same complete system throughout the world as we have here we could undoubtedly gain still more valuable information as to the working of the weather system. The natural laws are evidently the same though they may not in all parts be in the same balance as here. On the basis of the strongest power prevailing, there may be certain apparent variations which may appear to conflict, when in reality they all follow the same general law.

WASHINGTON, D. C. TO BE CONTINUED.

ON CLIMATIC CHANGES IN THE PRAIRIE REGION OF THE UNITED STATES.

THE EFFECT OF DISBOSCATION ON CLIMATE, AND THE RELATION OF FOREST GROWTH TO ATMOSPHERIC PHENOMENA.

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In the physical structure of the continent two destructive features are presented: one, a vast interior area of thinly wooded prairie, treeless grassy plains and arid deserts; outside of which is found the true forest region—the other distinguishing characteristic. No continent of the earth presents these geographical facts to such an extent. in such magnificence, in picturesqueness of landscape, grandeur of forests, length of water-courses, volume of streams, luxuriance of grasses, richness of soil, or susceptibility to a diversified agriculture equal to the immense area included in the limits of the United States. The irregular line which circumscribes the vast interior of the North American continent, is thus correctly drawn by Mr. Lewis H. Morgan in his "Migration of Indian Tribes."—*North American Review* Vol. 108.

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The prairies to which this paper is confined, he says: "Stretch from latitude 29°, and south of it to the north of Peace river, in the Hudson Bay Territory, in latitude 60° north. In their greatest lateral expansion they extend from the western part of the State of Indiana in longitude 9°, to the eastern base of the Rocky Mountains in longitude 28°, west of Washington. From this line of their greatest width from east to west, they gradually contract both northward and southward, forming a vast inland plain carpeted with grass, watered by great rivers, and encompassed by forests. The boundaries of this central prairie region will be made familiar by tracing briefly their circuit. Commencing upon the Rio Grande, which forms in part the southern boundary of the United States, and following the general line that separates the forest from the prairie northeasterly, a narrow belt of forest is found in Texas bordering the Gulf of Mexico, but penetrated here and there by the prairie which reaches the gulf at several points, as at the mouth of Nueces river and at Matagorda Bay.

"Louisiana, the eastern part of Arkansas, and the southeastern part of Missouri were originally forests, while all west of this was prairie, with the exception of narrow fringes of forests along the rivers and water-courses, and of small and irregular belts of timber upon the lowlands. Crossing the Mississippi above the mouth of the Ohio, the prairies follow the wide belt of woodland along the northern bank of the Ohio until they reach and penetrate the State of Indiana, where their eastern limit is found, with the exception of prairie openings in central and eastern Indiana, and western Ohio. Turning thence in a northwesterly direction, the prairie touches the foot of Lake Michigan at Chicago, from which point northward the belt of forest along the western shore of Lake Michigan widens so that the dividing line passes a number of miles west of the head of Lake Superior, whence it continues near the chain of small lakes to Lake Winnepeg.

"Keeping to the west of this lake, and of Lake Manitoba, which is also bordered with forest, the boundary line of the prairies runs northwesterly to near the west end of Athapasca Lake, where it crosses Peace river, and extends beyond to Hay river, near the sixteenth parallel, after which it bears southwesterly to the slopes at the foot of the Rocky Mountains. East, north and northwest of this line there is forest, whilst all within is prairie. Upon the plateau of Peace river, in the far north, are found the northern limits of those magnificent fields upon which no eye can rest without wonder and admiration. Southward, along the base of the Rocky Mountain chain, the lower slopes of which are wooded to the edge of the plains, the prairies spread out uninterruptedly to our starting point on the Rio Grande.

"This vast area, which traverses thirty-one parallels of latitude, and nineteen parallels of longitude, in its greatest continuous expanse measures more than seventeen hundred miles from north to south, more than one thousand miles from east to west, and embraces upwards of eight hundred thousand square miles. It is not entirely a treeless region, neither is it separated from the surrounding forests by a sharply defined line."

Only the region beyond the Missouri—confined principally to the states of

Texas, Kansas, Colorado and Nebraska—known as the Great Central Plains—is made the subject of this paper. It would require more space than could be allotted to a magazine article, to treat exhaustively the whole prairie area immediately exterior to the regions enumerated, the results of which, however, would vary but little materially, and only in degree incident to differences in latitude and inherent qualities of soil.

In one of the earlier Agricultural Reports, by the Commissioner of Patents to Congress, the late and deeply lamented Professor Joseph Henry, then Secretary of the Smithsonian Institute, describes the physical geography of the "Great American Plains" as follows: *"From the eastern edge of what we have called the mountain system—that is from the foot of the Rocky Mountain chain to the Mississippi river—a space comprising about one-third of the whole territory of the United States, the surface consists of an extended inclined plain, which slopes eastward to the Mississippi, and southward to the Gulf of Mexico, having at the greatest elevation, near the intersection of the parallel of forty and longitude one hundred and five, a height of upwards of five thousand feet, whence it gradually declines to the Mississippi river to about one thousand feet. At the parallel of thirty-five it has nearly the same elevation, and thence it slopes to the bed of the Mississippi about four hundred and fifty feet, and south to the level of the sea at the Gulf of Mexico.

"This extended plain is traversed by a number of approximately parallel rivers flowing east and southward to the Mississippi and the Gulf of Mexico, which have their rise principally in the mountain system, and are chiefly supplied by the melting of the snow and the precipitation of vapor which takes place at the summit of the ridges. The rivers are sunk deeply below the general surface of the plain, and give no indication of their existence from the distance, except from the appearance of the tops of the cottonwood trees which skirt their borders."

The same authority, in touching upon the general character of the surface and soil of the region under discussion, in its relations to possible productiveness, says: "The portion also on the western side of the Mississippi, as far as the ninety-eighth meridian,* including the states of Texas, Louisiana, Arkansas, Missouri, Iowa and Minnesota, and portions of the territory of Kansas and Nebraska, are fertile, though abounding in prairie and subject occasionally to droughts. But the whole space to the west, between the ninety-eighth meridian and the Rocky Mountains, is a barren waste, over which the eye may roam to the extent of the visible horizon, with scarcely an object to break the monotony."

The distinguished scientist just quoted found, however, before his death, good reasons to change his views in the light of the meteorological records that were completely stultifying previously and hastily formed opinions upon indifferent data, and admitted to the writer some two winters since, the fact of climatic changes in the prairie region of the United States, but was not fully prepared to assign their cause outside of cosmic forces.

That from the ninety-eighth meridian of longitude west from Greenwich, to

* Report of Commissioner of Patents, 1857.

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the base of the Rocky Mountains, there exists a "barren waste"—a dry, parched up and uninhabitable region—in fact a desert in the most rigid conception of the term—was firmly believed by the scientific world less than twenty years ago, and is as easily accredited to that region, to-day, by thousands whose knowledge of the geography of the United States, is confined to the description contained in the text-books of their school days, dated a quarter of a century or more in the past.

That the climate of the entire region between the Missouri river and the Rocky Mountains has changed within the last twenty years, and is at present slowly changing, or that the meteorological observations, upon which all the earlier reports of the Great Plains have been based, were incorrect, and do not in the conclusions drawn from them at the time of their compilation accord with the facts as they are known to exist, and that the whole of the vast interior area of the continent west of the ninety-eighth meridian, is not a "barren waste"—is not the "Great American Desert," confidently accepted as true at the date of the report quoted above, and as erroneously believed in by many people, to-day, it is the purpose of this paper to attempt the proof.

While it is true, perhaps, that there are relatively large districts of the Great Plains which must forever remain bound over to a hopeless bondage of sterility, the greater portion that is deemed by thousands in the East as an irreclaimable desert, is surely succumbing to climatic changes, and the remainder, when subjected to an improved system of irrigation, will invite a happy and prosperous population. Another portion again, though precluded by the remorseless rigor of immutable law from a high agricultural development, will remain the great pasturage for the herds of the markets of the world.

The time is not remote, if we may judge from the wonderful phenomena the rapid civilization of the plains presents to-day, when that whole vast expanse of country from the ninety-eighth meridian, to the very foot of the mountains, along their whole length, will offer a picture of the most gigantic and diversified system of agriculture the nations have ever seen. That there is a comparatively rich future for the agriculture of extreme western Texas, Kansas, Colorado, Nebraska, and Wyoming. I think the recorded meteorological phenomena of the immediately preceding ten years and the experience of that pioneer population, whose thrifty little homes dot the wide belt of country beyond the ninety-eighth meridian, will confirm.

The cause, or causes, that have, and are, effecting the amelioratirg conditions claimed, are believed by the writer purely local, and apparently, directly or indirectly, attributable to the march of civilization in its ever onward, restless course westward. If these changes in climate are not taking place, and are merely the result of an enthusiasm which the pure air of that section incites, then it must follow as true, that the aqueous precipitation of the Great Central Plains, in its form of rain and melted snow has been—until the last decade at least—differently reported from the facts, in their relations to means and annual totals in inches.

Though true for the limited districts of observation, perhaps, and strictly true for the whole area under consideration in the relations of distribution—which appears to be constant for the entire inter-ocean region—the tabulated results present an array of figures opposed to the agricultural possibilities of that portion of our country, and are directly stultified by the experience of the inhabitants—but from which the "aridity" and "barrenness" have been determined. It is believed that a study of the facts presented in this paper will lead to the conclusion that both of the propositions introduced above, are factors in the problem to be discussed—in other words that climatic changes have, and are taking place, and that the meteorological observations have not been accurately recorded, at least as previously stated, until the last ten years. Not that the latter has been done with a purpose to misrepresent the true meteorological phenomena of that immense interior area, but from causes unavoidable, and from an insufficiency of data to obtain reliable results when considering such an extensive region in its entirety, but too few observations, and too limited districts to correct the errors of non-periodic variation for the scope of country included in the results as tabulated.

A mere glance at the immense disadvantages under which the bureau has labored, to whose charge the meteorological observations of the country have been committed, will dissipate any idea of unjust criticism that may possibly be superficially attributable to the writer in the statement of his propositions.

Until the year 1819 scarcely any record of the meteorological phenomena of the United States was kept. At that date the office of Surgeon-General of the Army was created, and immediately orders were promulgated from that department to the medical officers stationed at the various military posts "to keep a diary of the weather." For seventeen years—until 1836—this "diary of the weather," which was made a part of the specific duties of the medical officers of the army, was limited in its tabulation to the mere temperature of the air and the direction of the wind.

In 1836 rain-gauges were first furnished to the military posts, and the observations of the precipitation in rain and melted snow recorded. In 1843 the system of observations was extended, and at that time the foundation of that magnificent plan for recording the meteorological phenomena of our country was laid, from the results of which, to-day, the medical department of the army may justly gather some of its greenest laurels.

In 1855 a series of hyetal charts was prepared under the direction of the Medical Department of the army, by Mr. Lorin Blodget, based upon the imperfect, or rather incomplete records of observation of the previous years, which unfortunately have been generally accepted as indisputable authority whenever a discussion of the public domain beyond the Missouri touches upon the susceptibility of that region to agricultural development, the argument invariably closing *unfavorably* in its relations to that subject, upon a mere inspection of the curves, and maximum and minimum figures indicative of the aqueous precipitation of the included areas. It was not intended by the constructor of the hyetal charts

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under discussion, that they should be received as the final results of a perfected system, but as approximate in their character only and the basis merely of a method which could reach its absolute conclusions alone through a prolonged interval of time. For at the date of the publication of these charts, there were but two or three military posts in all that vast area comprehended in their system, and these were separated by relatively immense distances, the recorded observations at which stations were consequently determined for large districts and covvered only short periods.

By a single glance at any military map for the years prior to the Mexican war, it will be noticed that only Forts Leavenworth and Scott, in Kansas, and one or two posts in the Indian Territory were established before 1849—and these located on the extreme edge, as it were, of the Great Central Plains—so that all the data available in the construction of Mr. Blodget's charts, in their relevancy to that portion of our country which is made the subject of this paper, were confined to the observations at these stations on the mere periphery of the immense interior region of the continent, to a few remote and isolated posts a short distance within that periphery, and the obviously inaccurate and unreliable reports of surveys and exploring expeditions across the Plains, too hurried to be of any value. These charts, therefore, which were intended as approximations only, originally, have been accepted generally as the true exponents of the rainfall and distribution of the third of a continent, in direct opposition to the ideas of their projector and to the now established meteorological phenomena of that region—are accurate only for the eastern portions of the Mississippi Valley, and the contiguous country to the Atlantic coast.

Then the data from which they are constructed, are the results of observations at stations with limited areas, and extending over more than half a century—for this region they reflect great credit upon their author for their scientifie value, but for the scope of country west of the Missouri are of little use, except to show the constancy of some of the phenomena of aqueous precipitation in the United States, in contradistinction to that of Europe, but distinct from the annual fluctuation of the rainfall and its totals of measurement.

As stated by Mr. Blodget, the phenomena of "symmetry and uniformity over large areas, seem to be the great distinguishing characteristic of the meteorology of the United States in its division of the precipitation of moisture. But the constancy of this phenomenon in no sense affects the question, or probable slow change in the quantity of rain or snow, due to rapidly accumulating local influences, which appears to be the fact, or the question of possible variation in distribution—the latter feature, however, is not insisted upon, or is very small if it exists at all—limited in this aspect of the phenomena of the aqueous precipitation to a transcursion of the summer rain-fall into that of autumn.

The rain-fall of the United States presents three peculiarities in its distribution: First—That which falls upon the region east of the prairie limit on the Atlantic slope, varies but little in its measurement between the seasons, or is *equally distributed.* Second—That which falls in the Mississippi Valley is *unequally*

distributed—the rains of spring and summer aggregating nearly three quarters of the annual precipitation. Third—that which falls on the Pacific coast is *periodic*, causing a wet and dry season.

It is to this marked feature of unequal distribution in the immense prairie region of the interior of the United States that we must look for the cause of its treeless condition, and in this connection must devote some space to the origin of the Great Plains and their source of moisture.

In the consideration of the theories that have been advanced by scientists to account for the origin of prairies, in order to arrive at satisfactory conclusions we must recognize three facts which accompany the variability of forest growth. First—In those regions where the rain-fall is large, and is distributed equally between the four seasons, we find dense forests. Second—Where the rain-fall is distributed unequally, the grassy plains are the distinguishing feature. Third—Where the rain-fall approaches zero, we meet the absolute desert. To avoid too great an elaboration of the subject, "The Origin of Prairies," I quote from a concise review of the several theories which have been advanced, as follows:

*"The great controlling influence which has operated to exclude trees from so large a portion of our territory west of the Mississippi, is unquestionably a deficiency of precipitated moisture. To this cause are due the prairies of Oregon, California, New Mexico, Utah, Nebraska, Kansas, Arkansas, and Texas. Throughout this great area, we find every variety of surface, and soil of every physical structure or chemical composition—unless in exceptional circumstances, where it receives an unusual supply of moisture—if not utterly sterile, covered with a coating of grass. * * * * * To the Great Plains, the typical prairies of the Far West, the theories proposed for the the origin of prairies, viz., that of Professor Whitney, that they are due to the fineness of the soil; or that of Mr. Lesquereux that they are beds of ancient lakes; that of Mr. Desor that they are the lower and level reaches of sea-bottom; or finally that which attributes them to annual fires; are alike wholly inapplicable. * *

* * The prairies bordering on, or east of the Mississippi, may be, and doubtless are, partly or locally, due to one or more of the conditions suggested in the above theories; but even here the great controlling influence has been the supply of water. The structure of the soil of the prairies coinciding with the extremes of and supply of rain characteristic of the climate, have made them now too dry and now too wet for the healthy growth of trees. A sandy or rocky soil or subsoil, more thoroughly saturated with moisture and more deeply penetrated with the roots of forest trees, affords them constant supply of the fluid which to them is vital. This, as it seems to the writer, is the reason why the knolls and ridges, composed of coarser materials, are covered with trees; while the lower levels, with firmer soil are prairies. Where great variation of level exists, the highlands are frequently covered with trees, in virtue of the greater precipitation of moisture which they enjoy."

From the date of the earliest explorations of the interior of the continent,

* On the flowering Plants and Ferns of Ohio, Dr. J. S. Newberry, 1860.

until quite recently, the cause of the treelessness of our Western prairies has been attributed solely to the annual fires which sweep over that region; and it is a favorite theory with many people, to day, who have studied the subject only superficially, but scientists have generally relegated the problem to the domain of meteorology, where is found its true solution.

Professor Dana, the eminent geologist, hints at the pertinency of Dr. Newberry's conclusions on the subject thus: *That prairies, forests and deserts are located by the winds and temperature, in connection with the configuration of the land. * * * * It is unquestionably true, however, that the annual fires have been an important factor in preventing the encroachment of the timber which fringes the rivers, upon the contiguous prairie, but only for inconsiderable distances, in other words; its action has been confined to a rigid line, whose course follows the contour of the stream where its supply of moisture to the soil of its banks ceases.

In his argument to prove that the prairies are not due to peat-growth or to the texture of the soil, Professor J. W. Foster (the very best authority on physical geography) says: †"It is a microscopic view to undertake to trace analogies between the formation of the prairies and that of the treeless morasses known as peat-swamps, as has been done by Lesquereux, a distinguished botanist, in the first volume of the "Illinois Geological Reports." It is a theory which presupposes a humid climate, a level country with imperfect drainage, and with a surface dotted over with lakes and sheltered from the winds, where the peat-producing plants could grow—conditions none of which obtain where the prairies assume their grandest proportions.

[Take for example, Kansas: So great is the relief and depression of the soil, that standing on one of the "rolls." I have commanded a view of forty miles in extent. The rise of the Kansas slope is two thousand two hundred feet in the distance of four hundred miles.

"Dr. Logan (Report on the Geology of Kansas, 1866) remarks: There is but little marshy or spongy soil in the whole State; the surplus water coursing down the natural conduits, leaves no opportunity for the saturation of the ground, which is observable in some of the other states, and particularly the prairie states east of the Mississippi river. * * * * Hence, no ponds or sloughs are formed, and but rarely any spongy soil."]

"We can hardly conceive of conditions by which the whole surface of a country would be converted into a peat bog. Such bogs are generally found occupying erosions in the surface, and where they are sheltered from the winds. There is no tendency to the formation of peat along the shores of the Great Lakes, where the waters are agitated by storms, nor along the margins of rivers of briskly-running water. Peat vegetation then only thrives in still waters, and where there is a tendency to stagnation; and the area over which it extends in a given region is inconsiderable, compared with the area occupied by other vegetable forms. The aromatic sage-plants, the cacti, and the bunch-grasses, are

*Manual of Geology, 1863. †"The Mississippi Valley," Chicago and London, 1869.

forms of vegetation which characterize the Western Plains, and are unknown in a region favorable to the growth of peat.

The Llanos of Venezuela have many features in common with the prairies; but they are subject, each year, to droughts so long continued and intense that the soil cracks and bakes, and the carbonized particles of vegetation are whirled through the air in the form of fine dust. Such climatic conditions would preclude the growth of peat vegetation. It is evident therefore, that we must resort to other and different causes to explain the phenomena of these grassy plains.

"Other physicists would attribute the formation of prairies to the mechanical or chemical condition of the soil,—a theory which we think equally untenable, when we reflect that the surface of these treeless plains may vary in every degree between drifting sands and impervious clays, and that the efflorescence of soda and gypsum which are the evidences of an arid climate at one extremity of the continent, would become fertilizing agents at the other. The forest of Fontainbleau thrives on a plain composed of sand to the extent of ninety-eight per cent. of the whole contents; the region of the Colorado Valley, the most desolate portion of the United States, is often underlaid by a blue clay so indurated as hardly to be impressed by a mule's hoof in passing over it; the soil of the Llano Estacado is red clay and gypsum, which under certain conditions of moisture, would be highly productive; and even the entire region of Sahara is far from being a mass of drifting sands."

It will be conceded that the question of the "Origin of Prairies," so far at least as their destitution of trees is concerned, is a purely meteorological one, and upon which can most satisfactorily be predicated the mutations that are rendering them adaptable to the support of a vast civilization, the nuclei of which only a few years since stepped hesitatingly within their enigmatical and mysterious confines.

The discussion of the cause of the treelessness of our Western prairies is a most important one when we enter upon the possibilities of their future in this connection; and in order to support the belief that man in his wonderful power to subordinate nature to his demands, can clothe the grassy plains with arborescent farms, and within certain limits change the climatic conditions favorably to this consummation, it is necessary to enter into all the details of the subject of moisture in its connection with its source in the region of the interior of the continent,—to compare the meteorological phenomena of to-day, with those which existed primarily, or before civilization had commenced its encroachments, and then determine whether the modifications assumed are facts, or purely visionary, or merely the recurrence of long cycles of variability.

The source of the rains which fertilize the United States, is found in the winds, that, laden with aqueous vapor taken up from the ocean and Gulf of Mexico, pass over respective regions and deposit their burden in the form of refreshing drops. It is only, however, the source of moisture of the Great Central Plains that we have space to discuss, though the whole subject in its relation to the entire continent is an intensely interesting one.

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*"The southwest winds of the United States are found to prevail with wonderful regularity on the Atlantic, north of the calms of Cancer; but in the region of the Caribbean Sea and the Gulf of Mexico, there are abnormal conditions which present a marked deviation from the fixedness and uniformity observable in the winds of the mid-Atlantic and the North of Africa. Both southerly and northerly winds blow with violence across the parallel of thirty (in the belt of the calms of Cancer) which, away from the American continent, acts as a great wall between the southwest and northeast winds. In the summer season, the northeast trades, hot and moist from the equatorial zone, as they enter the Caribbean Sea, are deflected by the lofty chain of the Andes which girds the coast, and pass into the Gulf of Mexico, where they become inland breezes on the coast of Texas; and as they penetrate the interior they are gradually deflected east, until they reach about latitude thirty-nine, when they assume the direction of the great southwest aerial current. It is this deviation from the regular flow, which gives to the Mississippi Valley its moist, tropical summer climate."

By a careful study of the statement quoted above—no longer disputed I believe, by meteorologists—we have a convincing cause for the unequal distribution of rain on the Great Central Plains. It is to the northeast tradewinds of summer then, as they are deflected and pass over the Gulf of Mexico, thence into the prairie region of the interior, that we are indebted for the excess of precipitated moisture in the first two seasons of the year, and why the plains are as well supplied with rain in summer as the Atlantic coast. If this were not the cause of the phenomena of the moisture of that region, and it depended for its supply upon the great southwest aerial current, in the zone of which the United States is situated, it would be of little use to discuss any agricultural possibility for the future of the interior of the continent, and climatic changes in its aspect of the rain-fall would be impossible.

Professor Foster, on the theory of the southwest winds being the medium of the moisture which falls upon the United States says: †"More than one writer on the climatology of the United States has maintained that the moisture which bathes the continent is mainly derived from the Pacific ocean, and distributed by the great southwestern current of winds, without taking into consideration how far that current is modified by the configuration of the continent. If this theory of the southwest origin of the moisture be true, we should justly infer that the winds of the Pacific, however highly charged, and apart from a great mountain barrier, in passing over seventeen degrees of longitude, would become dry winds long before reaching the Atlantic slope, and the conditions of the fertility of the continent would be reversed. The Alleghanies would be as desolate as the Purple Hills, and the Colorado Desert would be as fertile as the Valley of the Shenandoah."

We cannot, in attempting to establish the fact of climatic changes in the region of the Great Central Plains, restrict our inquiries to the single subject of the rain-fall, but are compelled to deal more or less with other meteorological phenomena,

*Professor J. W. Foster's "Mississippi Valley." †"Mississippi Valley," 1869.

in order that the intelligent reader may have the fullest data to reach his conclusions. It is necessary, then, in the determination of the postulate which is the basis of this paper, to institute a comparison between the various phases of the meteorological phenomena of the interior prairie area under discussion, as presented primarily—in this sense to the earlier observer—and the same divisions of the meteorological phenomena as they appear to-day.

Many of the conclusions that have been arrived at in relation to the Great Plains, are based upon the early literature descriptive of the prairies, and while much that is narrated therein is true, perhaps, more is false, and the prejudices engendered by the exaggerations which were accepted as facts, still cling to the popular belief, and, strange as it may seem, are yet incorporated in works that aspire, at least, to the scientific.

To show the general characteristics of the prairies beyond the Missouri, as they evidently were thought to be, and to portray features of that region which existed within the recollection of the writer, but which no longer exist or are modified, I quote from two authors on the subject:

"*Vast grassy plains, with trees restricted to the immediate banks of the streams—this is the character of the country between the Missouri river and the base of the Rocky Mountains, but as the traveler advances from east to west, he begins to notice increasing signs of dryness in the atmosphere, and of a more marked continental climate. The rain-fall becomes insufficient for the cultivation of crops, and the diurnal changes of temperature are too abrupt to permit the growing and maturing of the sub-tropical plants cultivated for food. The thermometer may rise to seventy or eighty degrees at mid day, and drop to below the freezing point at night. Not a cloud for days dims the luster of the sun, and at night are shed no refreshing dews. The purity of the air is so great that wild meats are cured without the aid of salt, and the grasses dry up without a loss of their nutritive properties. Surrounded by a medium so dry, elastic and bracing, the *voyageur* toils under a heat of ninety degrees without exciting excessive perspiration, and at the same time his system is proof against the chilling air of the night. Those stifling and enervating heats, and those cold and disagreeable storms, characteristic of the humid regions to the east, are here unknown, and the atmosphere itself becomes highly electrical. * * * * * * The buffalo or "gramma" grass, of which there are several species, is another marked type of the Plains. It grows in tufts, having a narrow, slender leaf, and where it exists in all its perfectness, the surface of the soil resembles a sheep lawn. It dies down under the heats of summer, and the climate is so dry that its nutritive properties are preserved, and thus, at all seasons of the year, it affords sustenance to the immense herds of buffalo which roam over the Plains."

The other author says: "†As we recede from the influence of the Gulf winds, and come in contact with the true climate of the prairies, it becomes constantly dryer, since the remaining region is now shut in upon the west by the double barrier of the Rocky Mountains and the Sierra Nevadas, which deprive

*Foster's Mississippi Valley, (1869.)
†Lewis H. Morgan, Migration of Indian Tribes, North American Review, Vols. 108-9.

the winds of their moisture in their passage from the Pacific eastward. After traversing about one hundred and fifty miles of Kansas, to the twenty-second meridian west of Washington*, the western limit of arable land in the prairie area under consideration is reached. Westward of this line the dryness of the climate continues to increase, the trees diminish in number and decrease in size, and finally disappear from the margins of the rivers. The grasses, yielding to the same influence, become less and less luxuriant, until the prairies, long before they reach the base of the mountains, degenerate, under the summer sun, into arid plains. Northward, on the Upper Missouri, the grasses never attain the luxuriance which they display in Eastern Kansas and Nebraska, by reason of the trend of this river, but on the upper Mississippi, and along the Red River of the North to Lake Winnipeg, they maintain a vigorous growth. The most perfect display of the prairie is found in the eastern parts of Kansas and Nebraska.

"It is no exaggeration to pronounce the region, as left by the hand of nature, the most beautiful country in its landscape upon the face of the earth. Here the forest is restricted to narrow fringes along the rivers and streams, the courses of which are thus defined as far as the eye can reach, whilst all between is a broad expanse of meadow-lands, carpeted with the richest verdure, and wears the appearance of artistically graded lawns. They are familiarly called the rolling prairies, because the land rises and falls in gentle swells, which attain an elevation of thirty feet, more or less, and descend again to the original level within the distance of one or more miles. The crest lines of these motionless waves of land intersect each other at every conceivable angle, the effect of which is to bring into view the most extended landscape, and to show the dark green foliage of the forest trees skirting the streams, in pleasing contrast with the light green of the prairie grasses. In their spring covering of vegetation, these prairies wear the semblance of an old and once highly cultivated country, from the soil of which every inequality of surface, every stone and every bush has been carefully removed, and the surface rolled down into absolute uniformity. The marvel is suggested how nature could have kept these verdant fields in such luxuriance, after man had apparently abandoned them to waste. This striking display is limited to about one hundred and thirty miles in the eastern part of Kansas, and a narrow belt in Eastern Nebraska."

Both of the above descriptions were written a decade ago, and in part, at least, were drawn evidently from the earlier and stereotyped idea of the Plains, and in part, perhaps, from limited personal observation of the mere portals, as it were, of the grand prairies of the Far West. Much of this is a faithful representation of the phenomena then existing, but which no longer exists, and many of the features so eloquently pictured are confined to limits ridiculously contracted in comparison to the whole area. What are the facts to-day? Where the rainfall was declared "insufficient for the cultivation of crops," magnificent farms have been opened, and results obtained which have definitely determined the question of the productiveness of the region; where no "refreshing dews" were shed, we

*West of Greenwich.

find dews as copious as in the most favored localities; and where ten years ago "wild meats" could be cured "without the aid of salt," putrefaction takes place as rapidly as in the most humid climate of the east. Now the temperature is more equable, the nights less chilly and the heat of the noonday sun less "stifling." Instead of the limit of arable land reaching only "one hundred and thirty miles," the country has a constantly and rapidly increasing population, and is successfully cultivated nearly *two hundred miles beyond* the line drawn by the last quoted authority, and each month the plow is turning up the sod, on its eager way to the horizon. The "golden belt," or great wheat zone, has not yet reached its limit, and where was considered a desert by the distinguished authors referred to above, may be seen the grandest yield of cereals on the continent. Where "the trees disappear entirely," young forests have sprung up, and the apple and the pear are making the prairie air redolent with the perfume of their sweet blossoms. But of this farther on, when we come to deal with the actual statistics. The buffalo or "gramma grass," referred to above by Prof. Foster, which once covered the whole region as far east as Fort Riley, is rapidly disappearing—(strange as it may seem, with the departure of the buffalo this grass appears to vanish, too)—and its place usurped by the succulent "blue-stem." Besides this, over extensive areas new forms have appeared, prominent among which is a species of wild barley, (*hordeum pretense.*) The timber that was "confined to the streams" is encroaching upon the contiguous prairie to an astonishing degree, where permitted by those who own the land where the phenomenon occurs. The cultivation of the bottom lands has made this encroachment possible, but it is not confined to the immediate low lands of the rivers and creeks. Fields that have been plowed in the summer or fall, comparatively remote from the water courses, are found in the following spring to be covered with shoots of the cottonwood, elm, box elder and other indigenous trees, from the seed wafted there by the wind. This phenomena can be witnessed to-day, three hundred miles or more beyond the Missouri river; these gratuitous growths attaining a height of from four to twelve feet according to species, in only two or three seasons.

In presenting some of these prominent facts, which will be extended farther on, what bearing they have upon or how far they answer the question asked by meteorologists half a century ago: "Whether in a series of years there be any material change in the climate of a given district of country, and if so, how much does it depend upon cultivation of the soil, density of population, etc.," the reader may judge; but his conclusions from the facts offered for his investigation it is believed will establish the affirmative of each division of the interrogatory, for the meteorological phenomena of the Great Plains when that region was in its primitive condition, compared with that which distinguishes it to-day, appear to confirm it conclusively.

The Great Plains of the interior of the continent are the field in which this question can be definitely determined, for that region during the last ten years has been under the test of rigid observation and experience. Three thousand

square miles of its surface has been completely metamorphosed by the encroachments of civilization, and not by a slow and erratic march, either, but by a steady, constant rapid flow, whose influx has converted extensive areas of the virgin prairies into thrifty farms in a single season, the immigrants not having to contend with the tedious process of subduing the forest, as did their ancestors of the densely-wooded Atlantic coast.

The opinions on possible changes in climate, in this particular of the influence of civilization over certain regions, have been usually based upon the meteorological conditions of Europe as presented to-day, and comparing them with what it seems to have been thousands of years ago; a method of research which is obviously based upon the grossest inaccuracies, the reliable observations too few, the periods of time too remote, and the changes so slow, that their ratio to alleged causes can scarcely be considered within the domain of probability.

The fact is that the southwest winds, laden with vapor from the Pacific ocean, part with the last drop of their moisture as they leave the lofty summits of the Sierra Nevada, and from there continue their course absolutely devoid of aqueous vapor, so that if the prairies of the region west of the Missouri depended upon these winds for their fertility, they would be only inhospitable deserts. The theory that the southwest winds of the Pacific are media of moisture for the central area of the continent, was a natural one, superficially viewed, and was materially assisted by the fact that the rains come with that direction of the wind. Without eliminating the other fact that the actual rain-bearing wind had really only joined the constant current from the southwest by deflection, it was natural to fall into the error.

Upon the question of distribution, considerable is still to be discussed, and before entering upon other branches of the meteorological phenomena of the Great Plains, some space must be devoted to it, that we may arrive at an intelligible summing up; for on the variability of the precipitation of rain over the four seasons, depends the possibilities of a fully developed system of agriculture in any region. Observation has proved that where the annual precipitation reaches nineteen or twenty inches, but is principally confined to the spring and summer months, the grasses revel in their greatest luxuriance to the exclusion of trees. But if the same amount be equally distributed, that region would justly fall under the odium of "barren waste" In consequence of this unequal distribution on the Western plains, where as previously observed, three-quarters of the rain-fall occurs in the spring and summer months, the "golden belt," as it is termed, or wheat producing zone, is pushed yearly farther toward the mountains, keeping pace with the advance of civilization.

Any change, then, in the distribution, with a tendency to equalization over the four seasons without an increased measure of inches, would prove disastrous to all hopes of a successful agriculture, and relegate those fields of golden cereals beyond the ninety-eighth meridian, to an arid desert. But this feature in the meteorological phenomena of the plains is apparently constant, and the changes that the march of civilization have made, are not disturbing its immutability with

other mutations in climate, and with an increased annual precipitation, this distinctive characteristic is preserved.

It has been shown that the treeless aspect of the prairie region is purely due to its meteorological conditions, that the rain-fall has not been sufficient to sustain forests on its soil *primitively*, on account of its limited fall in inches and unequal distribution; but how much less would it have sufficed, if it had been equally distributed? There are two systems of precipitation, therefore, in the economy of the rain-fall in the United States, which it is well in connection with our whole subject to examine. Professor Foster has condensed from the hyetal charts referred to, a representation of this phenomena, from which I quote, ignoring, however, the measurements in inches for certain areas which I am satisfied are incorrect—being mere approximations—but when used as a simple exponent of the "symmetry and uniformity of the rain-fall over large areas," fully explain this feature of the meteorology of the American continent:

*"*Winter*—The mouths of the Mississippi and the region of Pensacola are in the area of greatest precipitation. From this center, the lines of equal precipitation on the west, maintaining a considerable parallelism, first bear northwest along the Texas coast; then rapidly curving, bear northeast; then east, and, as they leave the continent, northeast.

Autumn—The mouths of the Mississippi and the region of Pensacola are within the area of greatest precipitation. The lines of equal precipitation pursue a north northeast direction.

Summer—The lines of summer precipitation, owing to the operation of the law of unequal distribution, are very irregular. On the plains they bear nearly north and south; but, as protracted east, they make one curvature to the south, as they approach Lake Michigan, and another still more abrupt, as they approach the Alleghanies; equal to five degrees of latitude—after passing which, they curve abruptly to the northeast.

Spring—The lines of equal precipitation exhibit a remarkable deflection to the northwest. * * * * While the mouths of the Mississippi and the region of Pensacola still receive the greatest amount of precipitation, Fort Laramie on the plains is nearly as well watered as New York on the seaboard; and Chicago receives no more rain than falls in Cheyenne, at the base of the Rocky Mountains."

In the above reference I have eliminated all the measurements in inches, and the tabulated results which accompany the conditions of each season as given, because they are to me manifestly incorrect; which statement is based upon my own personal knowledge and extended research and calculation in the meteorological records of the station.

A careful study of the phenomena of aqueous precipitation shows it to be one of the most erratic and fluctuating in its value of measurements; one year reaching an insignificant minimum, and the next year perhaps shooting far beyond the bounds of any accurate maximum for long periods, so that a diagram

*Foster's "Mississippi Valley," 1869.

of the annual fall for a series of years exhibits a curious instability of line, and it is only by taking the mean of a number of years, and comparing it with the mean of former similar periods that we can best show the increase or decrease over particular areas. A diagram showing at once the aqueous precipitation of the world would exhibit the same inconstancy of lines, for the blessing of rain is by no means equally distributed over the earth. In the British islands the average is one hundred and fifty-six rainy days in the year. Then there is the broad rainy belt of the tropics, one thousand miles wide, within which the rain pours periodically with torrent violence; and on the other hand there are the great rainless districts of Africa, Arabia and South America, including many millions of square miles on which the music of the rain-drops is seldom heard. At Muhableshwwr, in India, three hundred and two inches of rain have fallen in a single year, enough to cover the land with water twenty-five feet deep. On the Western Plains and in the mountains we have "cloud bursts;" where the rain comes down in limited areas in a perfect deluge, carrying everything before it in its power. (*To be Continued.*)

SCIENTIFIC MISCELLANY.

FLYING MACHINES IN ALL AGES.

Grecian fable points to the Athenian monarch Dædalus, contemporary of Theseus and Minoes, as the inventor of the first flying machine. Celebrated in poetic fiction as an artist and mechanician, the mythical story of his having crossed the Ægean by means of wings of his own construction is but one of many tributes to his inventive genius. Later on, the classics allude to many heroes who were successful in navigating the air; but the accounts when carefully examined usually resolve themselves into exaggerated stories of feats performed on ropes, wings having been probably employed for the purpose of making the exhibition more attractive, or perhaps to render the performance less difficult by the resistance to the air. Other instances are on record of persons who, by contrivances resembling the modern parachute, descended obliquely to the ground from the summits of high towers. Some time during the thirteenth or fourteenth century a monk named Elmerus is said to have flown more than a furlong from the top of a tower in Spain. This distance is, however, probably much exaggerated. In the seventeenth century Besnier, a lock-smith at Stable, in France, who prudently began from windows one story high, finally ventured to leap from very elevated positions, and so passed successfully over houses and also rivers of considerable width. All these were feats destitute of utility, though they encouraged the expectation of better results which was cherished by some of the most scientific men of that period. Bishop Wilkins (1648), in particular, devoted much attention to the subject. Perceiving the inadequacy of the human arm and

the muscles which move it to give sufficiently rapid motion to wings of sufficient size, he suggests that "it were therefore worth the inquiry to consider whether this might not be more probably effected by the labor of the feet, which are naturally more strong and indefatigable." So confident was the good bishop of success, that he anticipated a time when man should as readily call for his wings to make a journey as he did then for his boots and horse.

The first really important step toward what is learnedly called aerostation was made by the discovery of the balloon. This resulted from the experiments of two brothers, Stephen and Joseph Montgolfier, sons of a paper maker at Annonay, a French town about forty miles from Lyons. The young men had observed the suspension of clouds in the atmosphere, and it occurred to them that if they could inclose any vapor of the nature of a cloud in a large and very light bag, it might rise and carry the bag with it in the air. They accordingly made experiments, inflaming bags with smoke from a fire underneath, and found either that the smoke or some vapor emitted from the fire did ascend and carry the bag with it. Being thus assured of the correctness of their views, they determined to have a public ascent of a balloon on a large scale. They accordingly invited the States of Vivarais, then assembled at Annonay, to witness their aerostatic experiment; and on June 5, 1783, in the presence of a considerable concourse of spectators, a linen globe of one hundred and five feet in circumference was inflated over a fire fed with small bundles of chopped straw. When released it rose rapidly to a great height, and descended at the expiration of ten minutes at a distance of one and one-half miles. The news of this remarkable experiment spread to Paris, and a subscription was started for the purpose of raising money to repeat the experiment. This time the balloon was made of silk, varnished with a solution of gum, and through the suggestion of M. Charles, a professor of natural philosophy, hydrogen gas was substituted for the vapor emitted by the burning straw. During the process of filling the balloon, which took place at the Place de Victoire, the excitement became intense, and bulletins were issued daily noting the progress of the inflation. Finally the crowd throughout the neighborhood became so great that it was deemed wise to change the location. Accordingly the balloon was removed to the Champs de Mars—a distance of two miles. This was done secretly in the middle of the night, and the appearance of the balloon on its travels, preceded by lighted torches and escorted by a detachment of soldiers, is described by those who witnessed it as very remarkable. On the day of the ascent, which took place on the 27th of August, 1783, an immense concourse of people covered the Champs de Mars, and every point in the vicinity from which a view could be obtained was crowded. At five in the afternoon a cannon was discharged as a signal, after which the balloon was immediately let loose. It rose with great rapidity to a height of some 3,000 feet, more than satisfying the expectations of those connected with the enterprise. A shower of rain, which began to fall directly after it left the earth, in no way checked its progress, and the excitement was so great that thousands of well-dressed spectators, many of them ladies, stood exposed, watching the balloon intently the whole time it was in sight, and were thoroughly drenched. After

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remaining in the air some three-quarters of an hour, the balloon fell in a field near Gonesse, about fifteen miles distant, and terrified the peasantry so that they tore it into shreds.

After this, frequent experiments of the same character were made, but the first human being to mount in a balloon was a young Frenchman named Francois Pilâtre de Rosier. On the 15th of October, 1783, and on several subsequent occasions, he made successful voyages through the air; but his enthusiasm in ballooning finally resulted in his death. The honor of having made the first ascension in England has been ascribed to two persons—a literary man named Tyler and a foreigner called Lunardi. Although the former justly claims precedence by a few days, his attempts and partial success attracted little attention, while Lunardi's experiments excited the greatest enthusiasm, and were finally the means of introducing aerostation to the notice of English scientists. Lunardi's original balloon was thirty-three feet in circumference, and was exposed to public view at the Lyceum, in the Strand, where it was visited by upward of 20,000 people. After some difficulties in regard to arrangements, it was decided that the balloon should ascend from the Artillery Grounds, and on September 15 the inflation with hydrogen gas took place. It was intended that Mr. Bigin, an Englishman, should accompany Lunardi; but the crowd became impatient, and the latter deemed it prudent to ascend alone, with the balloon only partly filled, rather than risk longer delay. Unable to enjoy human companionship, he took with him a pigeon, a dog, and a cat, and made the ascent in the presence of the Prince of Wales and an enormous crowd of spectators. Shortly after starting the pigeon escaped, and within an hour and a half he descended in Hertfordshire and landed the cat, which had suffered from cold. He then ascended again, and descended after a lapse of three-quarters of an hour at Standon, near Ware, where he had great difficulty in inducing the peasants to come to his assistance. Finally a young woman seized one of the cords, and called the men to follow her, which they did.

The excitement caused by this ascent was immense, and Lunardi at once became the star of the hour. He was presented to the king, and was courted and flattered on all sides. To show the enthusiasm displayed by the people during his ascent, he tells in one of his own letters how a lady, mistaking an oar which he dropped for himself, was so affected by his supposed destruction that she died in a few days; but, on the other hand, he says he was told by the judges that he had certainly saved the life of a young man, who might possibly be reformed, and be to the public a compensation for the death of the lady, for the jury were deliberating on the death of a criminal whom they must ultimately have condemned, when the balloon appeared, and every one became inattentive, and to save time they gave a verdict of acquittal, and the whole court came out to see the balloon. The king, also, was in conference with his ministers, but, on hearing that the balloon was passing, he broke up the discussion, remarking that they might resume their deliberations, but that perhaps they might not see Lunardi again; upon which he, Mr. Pitt, and the other ministers viewed the balloon

through telescopes. From this time balloon ascensions frequently took place in England, the populace taking immense interest in such exhibitions. The result was the expenditure of large amounts of money and the loss of a few lives; but the balloon still remained a toy, resisting all efforts on the part of scientists to make it of practical value. During the wars of the present century balloons have frequently been been sent up for the purpose of observing the movements of the enemy, and ascents have also been made for scientific purposes, such as ascertaining the drift of aerial currents and the condition of the atmosphere at various heights. In the first case they were in some measure successful, but the contributions made to science through experimenting with balloons have been exceedingly small.

In the United States aerostation has been prosecuted with great zeal, and the adventures of Mr. Wise and other famous aeronauts have frequently served to amuse the public. Flying machines have also appeared from time to time, illustrating the force of Yankee ingenuity, but failing to command respect by their want of success. Recently, however, a new impulse has been given to the project of navigating the air by the invention of a flying machine in which the lifting power of the balloon is supplemented by a curious device which enables the operator to control his machine by the action of his feet

The lifting power is afforded by a horizontally placed cylinder of "gossamer cloth" (fine linen coated with India rubber) twenty-five feet in length and thirteen in diameter, weighing only sixty-six pounds, and charged with hydrogen gas, which is made by the usual process from iron turnings and sulphuric acid. Broad worsted bands extend over that and down to a rod of mandrel-drawn brass tubing, nickel-plated, one and one-half inches in diameter and twenty-three feet long. From that rod the machine is suspended by slender cords. The after-portion of the machine is at the base a parallelogram of rods two feet wide and five and one-half feet long, from which rise lengthwise curved rods eighteen inches high in the centre, and drawn near together at the top. All these rods are in reality hollow tubes of mandrel-drawn brass, light and very strong. Above the apex of this form rises a cog-edged steel wheel eleven inches in diameter, with double handles so geared to a four-bladed fan moving horizontally directly beneath that the operator can give the fan 2,000 revolutions per minute. The four blades of the fan are of white holly, each having a superficial area of about fifty square inches, and the extreme diameter of this revolving fan is twenty-four inches. The blades are set at a slight angle, like those of the screw of a propeller. Just behind the wheel is a very small seat, upon which the operator perches. His feet rest upon two light treadles above and in front of the fan. From the front of this form spring other rods, carrying at their extremity a vertically working revolving fan like that beneath the operator's seat, except that it is but twenty-two inches in diameter. It is so geared to the main or horizontal fan that it may be operated or not, at the pleasure of the driver of the machine, and can be made to turn from one side to the other so as to deflect the course of the machine in the air. This fan will make two thousand eight hundred revolu-

tions per minute when the other is making two thousand. All its movements are controlled by the operator's feet. When he presses the left treadle he throws it into gear, when he presses with the toe of his right foot it turns to the left, and a slight pressure of his heel whirls it over to the right. He can also reverse the action of his main fan, so that when it whirls one way he goes down, and when its course is reversed he mounts in the air.

The great problem which inventors of flying machines have always before them is the arrangement of a device by which they shall be able to propel their frail vessels in the face of an adverse current. Until this end shall have been achieved there will be little practical value to any invention of the kind. In Professor Ritchell's machine, however, the difficulty has been in a great measure overcome. On the occasion of the trial trip, which took place on Wednesday, June 12, at Hartford, Connecticut, the new air ship rose to a height of two hundred feet, and sailed off until over the Connecticut river, the operator meanwhile exhibiting his power to change its altitude and direction at will. When he ascended there was but little wind blowing, and the machine appeared to be under perfect control; but gradually a breeze sprang up, and it was deemed safest to make a speedy return, as there were indications in the sky of a gathering storm. The machine turned and made its way back in the teeth of the wind until direc ly over the ball ground whence it had ascended, and then alighted within a few feet of the point from which it had started.

It yet remains to be seen whether the new machine can be perfected so as to make it available for any useful purpose. At present, however, it is a great success to the inventor, vindicating so thoroughly as it does the correctness of the principles upon which its construction was based.—*Harper's Weekly.*

IMPROVEMENTS IN MUSICAL INSTRUMENTS.

Two very remarkable improvements in musical instruments are occupying the attention of mechanics and musicians at the present time, which are of more than usual interest; the one bears upon the prolongation of a pianoforte note at the will of the performer. Hitherto the note could not be sustained after the finger was removed from the key. By Messrs. Kirkman's new invention, the same note can be made to sound for a lengthened period at the will of the performer. To accomplish this object a double set of hammers is required; these are fixed by delicate watch springs to a hollow brass rod, extending nearly the entire length of the instrument, and they are set in motion simultaneously by a treadle action of an additional pedal. This treadle causes a fly-wheel to revolve at any required speed, which in its turn communicates a vibratory motion to the brass rod upon which the hammers are fixed. An action similar to that of a row of electric bell-hammers is now set up, but somewhat short of striking distance from the strings; but on pressing down a note on the key-board, however softly, the

handle of the still vibrating hammer is depressed, and, coming in contact with the wire, produces the effect of either a *tremolo* or a sustained note, in proportion to the speed with which the treadle is worked. Thus it will be seen that the *tremolo* would have a soft, and the sustained, a loud tone, so that here the additional advantage of a swell is attained, as perfect as that effected by the expression stop of the harmonium.

The manipulation of the keys for the melo portion of the instrument is precisely the same as the creeping movement required for the organ, excepting when it is desired to add the force of the regular hammers, when the movement would be that in use for performance on the piano. The amount of volume of sound produced when the instument is put to its full power is perfectly astonishing, though perhaps not more so than the suddenness with which it can resume the softness of a dulciana and stopped diapason effect on a small organ. The quality of tone is difficult to describe, as, although a stringed instrument, the melo-piano partakes very much of the tone of a harmonium; its full beauty can, however, only be appreciated by hearing its effect. Its introduction certainly should mark the commencement of a new era in piano manufacture.

The second improvement in existing arrangements, to which we refer, relates to organ pipes, which at the present time give out but one note each on the reed being acted upon in the ordinary way. But there is no reason why an organ pipe could not be rendered as capable of giving out as many distinct notes as a flageolet or flute, by merely attaching to it a series of valve stops at certain intervals throughout its entire length, their action being as easily controlled by the player as the key notes of the lesser instruments we have named.—*Industrial Art.*

—The Persian carpets in the Paris Exhibition are said to be very wonderful, some having been made three hundred years ago, and looking to all appearance not, indeed, "as fresh as paint," because that gives an impression of gaudiness, but as good as ever. Some of them have been in constant use for the time above named, and are even now by no means shabby. They are woven in hand looms on a web of cocoon silk prepared with certain alkaloids which insure them against the moth. "The wool forming the pile is knotted many times before the loop giving it the velvety appearance is cut. As each knot is made it is hammered flat. A live coal might fall upon this carpet and remain on it for some moments without leaving an indelible mark, so deep are the strata of loops and knots." They are the handiwork of wretchedly poor weavers, who have probably received more kicks than half-pence for their pains.

A WATER COOLING FAUCET.

This faucet, through which water is drawn as cold as ice, is the invention of a Californian. Boiling water placed in any receptacle and allowed to run through, will be found cool and fit to drink. The faucet contains numerous

small tubes enclosed in larger ones, and between the outside of one and the inside of the other chemicals are packed which produce the desired effect. For these chemicals it is best to use simply nitrate of ammonia, moistened with water; the cooling effect will last until all the nitrate is dissolved, when it must be renewed. The salt may afterward be regained from the solutions by evaporation, and can be used over and over again for an unlimited time.—*Manufacturer and Builder.*

ANCIENT SOAPSTONE QUARRIES.

Prof. Baird, of the Smithsonian Institution, is preparing to send, within a few days, one of the scientific specialists in his employ into Virginia, to prosecute the archæological investigations begun under the auspices of the Institution. The region of the investigation lies in Amelia county, about fifty miles south of Richmond, where there have been discovered quarries of soapstone, or steatite, which appear to have been worked by the aboriginal inhabitants of the continent. Extensive traces have been found of these ancient quarries, out of which were procured the pots and various domestic vessels used by the aborigines of this region. A great number of specimen articles have been obtained already and brought to Washington. The examinations which have thus far been made, prove that the quarries were abandoned at least four hundred years ago, there being found in them no vestige of iron or other metal implements, while the remains of the various implements with which they were evidently worked are abundant. A forest of pine and oak has also overgrown the site of the ancient excavations, the trees, in some instances, being nearly two feet in diameter.

The pots which were taken by the early Indians from these beds of steatite appear to have been carved with the bottoms upward, and then broken from the rock. The evidences of their having been so obtained are numerous, the vessels being found in every stage of completion in the bottoms of the quarries. The spot in the quarry at which the original excavations were begun has also been ascertained, and by an examination of this and the subsequent workings, the steps of progress in the art of excavation and of shaping the pots has been made obvious. In the beginning, the excavators appear to have employed their ordinary stone axes, as is seen from the number of these broken instruments at a single point in the quarry. As the traces of these implements are found nowhere else in the excavation, it is inferred by Professor Baird and his assistants that this mode of quarrying was given up as being too costly, the labor of making a single stone ax to replace a broken one being in itself the work of years. Later the pots seem to have been quarried with flint adzes, fashioned especially for the purpose out of a neighboring flint ledge. The site of this ledge has been found, and numerous adzes procured from it are strewn everywhere in the quarry. In addition to these facts, there are other interesting details of this discovery which will be given for publication after the return of the expedition, which is to be made for the purpose of ascertaining the full extent of the excavations, and for observing more closely the traces of the ancient people who made them.—*N. Y. Tribune.*

MEDICINE AND HYGIENE.

DISEASES OF THE EAR FROM BATHING.

Under this heading, Dr. Samuel Sexton, of the New York Ear Dispensary, communicates to *The Medical Record* an elaborate and instructive paper on the dangers of sea-bathing. He attributes many cases of aural disorders and partial or total deafness to the incautious manner in which many bathers battle with the surf, dive under water, and expose themselves to the cold wind, permitting the hair, ears, etc., to dry by evaporation.

The following conclusions sum up the substance of the article and afford sound advice for sea-bathers:

"The ear is far oftener the seat of inflammation and resulting deafness from bathing than is generally supposed. Although its delicate parts occupy a deep situation in the skull, which is usually a protection from objects capable of injuring it, yet in any bathing which includes immersion of the head, it is liable to be more or less damaged.

"This damage consists in the admission of water into the ear, either through the external auditory canal, or the Eustachian tube.

"When water finds admittance to the former, if cold or salt, inflammation of the meatus alone may result, or if violently injected, as in surf-bathing, or long retained in the canal from diving, the disease may affect the drum-head and middle ear.

"Whenever water is forced from the mouth and nostrils into the middle ear through the Eustachian tube, inflammation of the middle ear is almost sure to occur, even though the water be warm. This has been frequently illustrated in a most painful manner by those who have been induced to use the popular nasal *douche*, inflammation of an acute purulent character having frequently been thus established, which has been dangerous to the life of the patient, and after a tedious recovery left great deafness behind.

"Frequent exposures, especially in salt water bathing, may be the cause of slight ear-aches, which are usually neglected as unimportant, but which are frequently the precursors of much deafness.

"The fact that several thousand severe cases of aural disease thus result annually in New York city alone, should be a serious admonition to all who are concerned; and that three of the sixty-five cases here reported had dangerous cerebral complications, should be a further warning.

"That bathing is pleasant and healthful is of course admitted, but that it cannot be practised, as at present, without danger, is undeniable. It has been shown here by a glance at natural history that amphibia, whose life is passed indifferently in either air or water, have naturally the means of protecting their auditory apparatus; but man is not so constructed, and therefore he cannot with safety practice diving or submerging the head.

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"He should never dive if he wishes to preserve his hearing.

"When in the surf he should take the water upon his chest or back, closing the mouth and nostrils, being careful not to present the ear to the incoming wave.

"It is equally dangerous while swimming to receive dashing water into the mouth or nostrils. A firm pledget of cotton-wool in the ears is some protection. Drying the hair and body and dressing quickly after the bath are, of course, necessary precautions.

"The neglect to observe care in bathing is well illustrated by the four cases of aural disease, which I have presented here in the addendum as originating from the Russian bath, two of the attacks happening to physicians. This should point to the necessity of our always putting a patient, advised to use any kind of a bath, upon his guard as regards the danger to the ear."

RESULTS OF INTERMARRIAGE.

Mr. George Darwin, after searching investigation, concludes that "the widely different habits of life of men and women in civilized nations, especially among the upper classes, tend to counterbalance any evil from marriage between healthy closely related persons." Mr. Darwin's views are in a measure sustained by Dr. Vorni's inquiry into the commune of Batz. Batz is a rocky, secluded, ocean-washed peninsula of the Loir Inferieure, France, containing over three thousand people of simple habits, who do not drink, and commit no crime. For generations they have intermarried, but no cases have occurred of deaf-mutism, albinism, blindness, or malformation, and the number of children born is above the average.

HUNGARIAN LINIMENT.

Camphor pulv	40 parts.
Pimento pulv	20 parts.
Flour of mustard	40 parts.
Bruised garlic	20 parts.
Cantharid. pulv	10 parts.

These ingredients are digested for twenty-four hours in—

Vinegar	85 parts.
Rect. spirits	100 parts.

For frictions in cholera (Bouchardat.)

CUBEB BERRIES FOR CATARRH.—A new remedy for catarrh is crushed cubeb berries smoked in a pipe, emitting the smoke through the nose; after a few trials this will be easy to do. If the nose is stopped up so that it is almost impossible to breathe, one pipeful will make the head as clear as a bell. For sore throat, asthma, and bronchitis, swallowing the smoke effects immediate relief. It is the best remedy in the world for offensive breath, and will make the most foul breath

pure and sweet. Sufferers from that horrible disease, ulcerated catarrh, will find this remedy unequaled, and a month's use will cure the most obstinate case. Eating the uncrushed berries is also good for sore throat and all bronchial complaints. After smoking do not expose yourself to the cold air for at least fifteen minutes. The berries are perfectly harmless, and there is no use in going to a "catarrh doctor" while you can procure this remedy. They can be got at any drug store.—*Chicago Tribune.*

A Remedy for the Eruption Produced by Poison Ivy.—Dr. S. A. Brown, U. S. N., writes to the *Medical Record* that he has found in bromine a specific to the eruption produced by the poison-oak or poison-ivy. He says that he has used it with unvarying success in at least forty cases. The eruption never extends after the first thorough application, and it promptly disappears within twenty-four hours, if the application is persisted in, and the patient is entirely cured. He uses the bromine dissolved in olive oil, cosmoline or glycerine, in the strength of from ten to twenty drops of bromine to the ounce of oil, and rubs the mixture gently on the affected part three or four times a day. The bromine is so volatile that the solution should be renewed within twenty four hours from its preparation.

BOOK NOTICES.

The Commonwealth of Missouri—A Centennial Record, Edited by C. R. Barns. St. Louis, Bryan, Brand & Co., 1877, pp. 936, large octavo. Cloth, $5 00.

This work, prepared in accordance with the suggestion of President Grant, at the opening of the Centennial year, was expected to be completed by the close of that year, but its magnitude prevented and it has only been ready for distribution a few months. Its principal contributors are A. J. Conant, the well-known artist of St. Louis, who furnished the excellent article (122 pages) on Archæology; Col. W. F. Switzler, the veteran editor of Missouri, who has ably writen up the Historical section; Prof. G. C. Swallow, formerly State Geologist, who contributed the article on Physical Geography; R. A. Campbell, that on the Material Wealth of the State; Prof. W. T. Harris, who naturally and fitly took charge of the subject of Educational Progress, and other writers who furnished the numerous biographical sketches of the more or less distinguished men of the State. It is a valuable work and one that reflects credit upon its publishers, as well as upon those whose literary ability and artistic skill made up its subject matter.

Studies in Luke—Reprinted from the "Emphatic Diaglott." By Benjamin Wilson. New York, S. R. Wells & Co., pp. 160, 12mo. For sale by M. H. Dickinson, successor to Matt. Foster & Co. 60c.

XUM

This little brochure is separated from the main book, ("The New Testament in Greek and English," by the same author), for the use of teachers and others in connection with the International Sunday school lessons for the third and fourth quarters of 1878. It is put into a very compact and convenient form, and, as the arrangement given will show, cannot fail to be of great service to all students of the New Testament, whether acquainted with the Greek language or not. Its peculiar features are an approved Greek text with the various readings of the Vatican manuscript, No. 1,209; an interlineary, literal, word for word, English translation; a new version on the margin of each page, with the signs of emphasis; a copious selection of references; many appropriate, illustrative and exegetical foot-notes, and a valuable, alphabetical appendix of names, weights, measures, &c. We quote a few lines from the preface: "The intelligent reader will at once perceive the utility and importance of this arrangement. Readers who are familiar with the original tongue obtain in this work one of the best Greek Testaments, with important ancient readings, well worthy of their attention; and it is presumed that there are even few Greek scholars, who are so far advanced but may derive some help from the translation given. Those who have only a little or no knowledge of the Greek, may, by careful reading and a little attention to the interlineary translation, soon become familiar with it. This work, in fact, places in the hands of the intelligent English reader the means of knowing and appropriating to his own benefit, with but little labor on his part, what has caused others years of study and some toil to acquire." The typographical execution, both of the Greek and English portions, is admirably clear and perfect, and, as before suggested, it cannot but be an excellent aid to students of the New Testament. The whole work, gotten up upon the same plan as this book of Luke and containing eight hundred and eighty-four pages, sells for $4.00.

THE PACIFIC RAILROADS, (Illustrated), pp. 95, octavo, paper cover. New York, D. Appleton & Co., 1878. For sale by M. H. Dickinson, successor to Matt. Foster & Co., 75c.

Of all the hand-books for travelers that have fallen under our notice this season, this is by far the most complete and attractive, describing and portraying as it does the most picturesque and interesting portion of the United States, with unusual fidelity and care. The writer and artist have both taken great pains with their work and the result is a graphically prepared book illustrated with a map and nearly one hundred beautiful engravings. All who live in the West and have visited many of the localities depicted and described, will bear ready testimony to the truthfulness of both letter-press and illustrations, while those who have not will readily recognize in this work the handiwork of skilled observers and artists, to which is added the unsurpassed excellence of the Appletons in book-craft.

To such tourists as design visiting the Rocky Mountains this summer, and especially to such as have not visited them before, the work will be a most useful guide and companion.

XUM

THE NATURALIST'S DIRECTORY FOR 1878.—Edited and published by Samuel E. Cassino, Salem, Massachusetts, 1878; pp. 200; price $1.00.

This is an important work for naturalists, as it furnishes the names of more than two thousand and five hundred scientific men of the United States and Canada, arranged alphabetically and by departments; also a list of scientific societies and a catalogue of obtainable scientific books, arranged by subjects. This work has been done by Mr. Cassino with the assistance of Miss S. E. Brooks, Prof. Eaton, of Yale College, Prof. Goode, of the Smithsonian, Prof. Ward, Prof. H. Carrington Bolton and other naturalists of high standing, and as far as our examination has extended it has been thoroughly done. If no other object were attained than the putting into possible communication with each other the students of similar departments of science, the book would be worth much more than its price to them.

CATALOGUE OF THE UNIVERSITY OF CINCINNATI, 1878–9; pp. 104.

The University consists of three departments: The Academic, or department of Literature and Science, the School of Design and the Observatory. It is amply endowed and supported, and the course of study in the different departments is most comprehensive and thorough. Its cabinets and collections of minerals, fossils, etc., are unusually extensive and complete, as are also its apparatus for teaching and studying astronomy, mathematics, chemistry, &c. Its plan of instruction seems admirable, and the history of the institution shows that it has been remarkably fortunate in its Professors and successful in all its departments.

ON THE DIRECT PROCESS OF MAKING WROUGHT IRON AND STEEL.—By Chas. M. DuPuy, C. E., No. 4102 Spruce street, Philadelphia; pp. 12.

This is a reprint of a paper read by the author at the meeting of the Franklin Institute, October 17, 1877, which has attracted much attention among technologists. The "direct" process invented by Mr. DuPuy seems in brief to consist in placing the crushed iron ore, mixed with carbon and fluxes in proper proportions, in annular cylindrical sheet iron canisters and melting in ordinary reverbatory furnaces, into masses of metal which are transferred to the squeezer, made into blooms and rolled to muck bar without re-heating. The process meets the approval of some of the best manufacturers in the country and doubtless is a vast improvement, when fully perfected, over any now practiced.

LIFE: ITS PERILS AND SALVATION.—By Hon. S. S. Cox, M. C.; pp. 24.

The above is the title of a most eloquent and convincing speech made in the House of Representatives, June 4, 1878, in favor of the Life-Saving Bill, then under consideration. Mr. Cox has devoted much of his time for the past ten years in Congress to the humane and public-spirited object of rendering the merchant marine, and other branches of our naval service, less dangerous to human life; and to his skill in legislative work, pertinacity and earnestness in urging the importance of the matter at all times, is due the comparative efficiency of our coast life-saving service, more, probably, than to the efforts of any other man in Congress.

XUM

CENTENNIAL CELEBRATION AT SANTA FÉ, NEW MEXICO, July 4, 1876; pp. 64, octavo.

We are indebted to Major David J. Miller, chief clerk in the office of the United States Surveyor-General of New Mexico for the above-named pamphlet, containing, among other interesting items, an historical sketch of Santa Fé, by Major Miller, in which the author contends that Santa Fé is really the oldest settled town in the United States, not excepting Saint Augustine, Florida. This is a most valuable paper and we hope at some future time to make copious extracts from it, as important contributions to the history of that little known portion of our country.

EDITORIAL NOTES.

KANSAS CITY ACADEMY OF SCIENCES met at its rooms on the evening of June 25, with the expectation of hearing Dr. Heath of Wyandotte, on "Peru and its Antiquities;" but owing to a sudden illness the lecturer was unable to be present, and the audience was disappointed. Dr. Fee, of this city, however, read a carefully prepared paper upon the "Material Basis of Life," which was listened to with marked attention. Mr. Eccles, of Brooklyn, New York, a writer and lecturer of note, made a few remarks on the same subject.

After transacting some miscellaneous business the Academy took a vacation until the regular day of meeting in September.

PROF. E. C. CROSBY, of the public schools of this city, with his brother, Prof. A. B Crosby, is giving a series of Natural Science lectures before the Teachers' Institutes of Kansas, during the summer vacation. They are well provided with apparatus and other means of illustration, and from their well known ability and knowledge of the subjects to be treated, our Kansas friends may rely upon an interesting and instructive course.

A FEW weeks since Mr. Sargent, who has secured the sole right to exhibit Edison's Phonograph in the State of Kansas, brought the instrument to this city and gave a free exhibition to the editors of the city papers, at the Pacific House. The exhibition was a decided success, the instrument receiving and repeating songs, speeches, and other musical and unmusical sounds very perfectly.

It was quite observable that it repeated high, sharp, explosive notes, such as those produced by whistling and shouting, more exactly in the same key than those produced by singing tunes in a slow and prolonged manner. For instance, it reproduced the words and notes of "Ninety and Nine" far more truthfully than those of a German "warble" where the notes were prolonged and run together by the singer, and a tune whistled into it came back exact.

It was quite a treat and all heartily thanked Mr. Sargent for his courtesy in coming over the line for our edification.

THE value of the Mexican dollar as fixed by the Government January 1, 1878, was 99.8 cents. It is received by Government at that rate. There is no reason, therefore, why the Mexican dollar should not pass in ordinary business the same as our dollar of 412½ grains. Its bullion value is greater, and the two mills depreciation by Government is inappreciable in small transactions.—*Cor. St. Louis Times.*

PROF. SPENCER F. BAIRD, successor to Prof. Henry, as Secretary of the Smithsonian Institute, is one of the few men of note and position who has earned both by constant,

steady, intelligent personal work and study. From the day of his graduation at Dickinson College, Pa., until now he has been actively and laboriously occupied in the various branches of science to which he has specially devoted himself, and his promotion has been the direct result thereof.

In 1846 he was appointed Professor of Natural sciences in Dickinson College, where he had so recently been a student. In 1850 he was appointed Assistant Secretary of the Smithsonian Institute. In 1871 he received the additional appointment of Commissioner of Fish and Fisheries, and in 1878 the distinguished position of Secretary of the Smithsonian Institute, so long and ably filled by the lamented Henry.

His scientific researches have extended in many directions, but have been mainly confined to the mammals, birds, fishes and reptiles of North America, which, from his exhaustive investigations and descriptions, are now better known than those of almost any other country.

His literary labors have been extensive and continuous, embracing Translations of scientific works from the German; Reports on the Mammals of North America in connection with the Pacific R. R. surveys; a work on the Birds of North America in 1864; a "Review of American Birds," published under the auspices of the Smithsonian; also a work on the Birds of North America, with Dr. Brewer; also several Reports upon Fishes and Fisheries, including Inquiries into the decrease of the supply of food fishes in the U. S., and a number of minor papers on various kindred subjects, which have been published in the proceedings of the Philadelphia Academy of Science, the New York Lyceum of Natural History, etc. One of the most valuable works with which he has been connected is the Annual Record of Science and Industry, of which he is editor, and which has been published by him for the past eight years with the assistance of several leading scientists of the country.

While in college Prof. Baird was a classmate of Prof. Theo. G. Wormley, one of the most skillful and competent chemists in the United States, who also has risen to a prominent position—that of Professor of Chemistry in the University of Pennsylvania, by constant untiring study and labor.

If the results of the boring for coal at Rosedale are as indicated by the report made by Dr. Thorne, on page 210 of this number, it will be a very important "find" for Kansas City. We have inspected some of the coal dust brought up by the auger, and as far as we can judge from such specimens, it is of good quality, besides which, the gas, if it proves permanent, will be very valuable.

We were favored with a call from Prof. Moss, of the Colorado School of Mines, last week. He states that the school is growing in public favor, and that next summer the Faculty will probably inaugurate a series of excursions into the Mountains for the purpose of teaching the students geology, mineralogy and practical mining. This will be an attractive feature, and will add greatly to the advantages already possessed by the school in its proximity to the smelters and refiners at Golden, Georgetown, &c.

The *Scientific American Supplement*, one of the best practical scientific periodicals in the country, has done us the honor to reprint quite a number of articles from the Review lately, including those by Profs. Pritchett and Crosby, Mr. Stevenson and Miss Murdfeldt.

Professor Arthur Lakes, of Golden City, Col., has promised to furnish several original articles for the Review very soon, founded upon his own experience in Palæontological explorations. The Professor is an ardent explorer and a good writer, so that our readers may look for something both entertaining and instructive.

Col. H. Inman, of Larned, Kansas, promises an article for the September number, upon "The Works of the Mound Builders West of the Missouri River."

Dr. Heath, having recovered his health, will soon be ready to deliver his lecture on "Peruvian Antiquities," of which due notice will be given.

MR. A. J. CONANT, in his comprehensive article on "Missouri Archæology," in the *Commonwealth*, already noticed among our "Book Reviews," quotes liberally from the articles of Judge West and others, published last year in the REVIEW, besides sending the editor a complimentary note regarding them.

THE American Association for the Advancement of Science, Meets at St. Louis, August 21, 1878.

WE give in the following table a comparative view of the temperature at Kansas City during the month of July, for the years 1876, 1877 and 1878.

	1876.			1877.			1878.		
	7 a.m.	2 p.m.	10 p.m.	7 a.m.	2 p.m.	10 p.m.	7 a.m.	2 p.m.	10 p.m.
July 1st	68	73	63	76	75	76	67	78	66
2d	68	74	74	76	84	75	68	77	66
3d	80	82	77	77	76	76	68	77	69
4th	77	84	79	81	84	80	67	78	85
5th	74	82	76	83	90	81	80	87	74
6th	82	85	77	78	92	82	80	87	75
7th	83	88	78	87	92	81	82	85	77
8th	81	83	76	86	92	82	68	83	76
9th	74	83	75	72	84	74	76	86	78
10th	73	81	74	76	83	70	81	92	78
11th	81	83	78	70	80	65	81	90	80
12th	81	89	78	71	78	66	83	92	82
13th	75	90	74	71	82	71	84	92	82
14th	73	83	72	72	86	75	89	94	82

ITEMS FROM THE JULY PERIODICALS.

AMONG so many interesting items as are always furnished by the *American Naturalist*, it is embarrassing to attempt to indicate the best. Probably, however, the article upon "Diamonds," by F. M. Endlich, would most interest the general reader, while that upon the "Mound Making Ants of the Alleghenies," by the Rev. Henry McCook; or that upon "The Smallest Insect Known," by Gen. J. D. Cox, with their minute and technical descriptions, would best please the naturalist. There is nothing in the whole number that is not both entertaining and instructive, and the General Notes are remarkably well condensed and arranged.

THE *North American Review* contains no articles in its July-August issue that can be classed as scientific; but from a literary point of view it is fully equal to any that have preceded it. The essay by Mr. W. B. Lawrence upon "the International Obligations of the United States," is a tersely written and comprehensive article, intended to clearly define the rights of the United States in case of a war between England and Russia. That entitled "An Advertisement for a New Religion," is a combination of irony, sarcasm and indirect argument which it will trouble the evolutionists and positivists to answer, even though written ostensibly by an evolutionist.

IN *Popular Science Monthly* we find, among many good articles, one on the "Radical Fallacy of Materialism," which is notable from its intrinsic merit, as well as from the fact that its author, Mr. Eccles, is a former resident of this city.

The *International Review* gives us an article on the "Chinese Puzzle," by a citizen of San Francisco, in which the subject is remarkably well handled from every point of view. It deserves the attention of our Congressmen and State law makers.

THE *Scientific American* commences its 39th volume with the issue of July 6th. It has a deservedly wide circulation among all classes, especially among those engaged in mechanical occupations.

THE *Manufacturer & Builder* is also devoted to practical matters. The present number contains good articles on Architecture, Engineering, Building Materials, Ballooning, &c., original and selected.

THE leading articles in the *Boston Journal of Chemistry* are upon the Microphone, the Telegraph in Olden Times, and House Building, while the miscellaneous items are various, numerous and valuable.

THE *Polytechnic Review* devotes several pages to the Paris Exposition, the Old and New way of transporting Goods and Passengers in Pennsylvania, the Development of Photo-chemical processes, &c., &c.

THE *Phrenological Journal* gives phrenological and historical descriptions of the Hon. Carl Schurz and Mrs. Almira L. Phelps, also, the usual amount of interesting miscellaneous articles on popular subjects, medical, physiological and otherwise.